Pig Development Department

Towards January 2013

Updates, implications and options for group housing pregnant sows

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CHAPTER 1

INTRODUCTION

1. Introduction

The conditions under which pigs are kept are laid down in SI 311 of 2010, European Communities (Welfare of Farmed Animals) Regulations. There are a number of aspects of these regulations to be implemented on pig units. However, the requirement to house dry sows and served gilts in groups from January 1st 2013 poses the most immediate challenge to the Irish pig industry. In March 2012 Teagasc estimated 36 per cent of units (45% of national sow herd) to be compliant with SI 311 of 2010. While The Department of Agriculture, Food and the Marine (DAFM) has made grants available to cover the capital investment in new housing or conversion with a limit paid to any producer of 40%, many producers do not have access to the finances needed because of high levels of debt accrued during several years of poor pig prices and high feed costs. Irrespective of the severe challenge SI 311 of 2010 poses for Irish pig producers we can expect the majority of Irish sows to be group housed from 4 weeks post service to one week before farrowing in the near future.

Pig Health and Welfare will be a major focus of the work that will be undertaken as part of the forthcoming Teagasc/IFA Joint Programme. The principal determinants of good sow welfare in group systems are already well known from previous research and the experiences of other countries. These include highly trained and motivated staff with a good temperament and attitude towards animals, feeding adequate amounts of a nutritionally adequate diet, and good housing conditions. Nevertheless, the large body size and low body fat reserves of the modern Irish sow combined with her ability to produce very large litters places her at greater risk of stress and production disease challenges. While research from Moorepark and elsewhere clearly demonstrates that sow performance in most group systems is comparable to individual housing, lameness can be a challenge. In poorly designed group systems there is great potential for very poor sow welfare if the sows have to fight for access to feed, have difficulty avoiding aggressive encounters or do not have an appropriate place to rest. Lameness is often the end result of such welfare problems. Such group systems meet fewer of the sows needs than stalls and unplanned removal and mortality rates are likely to be higher than in stalls. This is why the wrong decisions made now with respect to group housing could have serious implications for the longevity of the national sow herd.

Sow longevity and more importantly sow lifetime performance have an underestimated impact on the profitability of a pig unit. Therefore the ultimate aim should be to put a sustainable group housing system in place in which sow health, performance and therefore longevity is maximised. This means that the design and management features associated with high sow welfare standards must be given careful consideration. A good knowledge of sow behaviour including how best to mix and train sows and gilts is required as well as a better understanding of ways of preventing and treating lameness. Great care must also be paid to ensuring that the system chosen is 100% compliant with legislation and ideally emerging issues with regard to sow welfare should also be taken into consideration. The latter means that it is worth being aware of the situation in other EU countries where stricter legislation on group housing is in force. A group housing system designed to account for all the issues mentioned above will ultimately require higher levels of financial investment than one designed to meet minimal standards. However, such investment is likely to be well rewarded by lower death and removal rates particularly of young sows.

These topics and more are presented in the subsequent chapters of this publication. This should serve as a reference document not only for producers switching to group housing but because of the inclusion of recent research findings and updates from other EU countries, also for those who have already converted. For those with the unenviable task of trying to decide which system to opt for, blueprints for the four main systems already in use in Ireland are provided as well as a breakdown of the advantages and disadvantages associated with each one.

CHAPTER 2

LEGISLATION

2. Legislation

2.1. STATUTORY INSTRUMENT 311 OF 2010

EU Council Directive 2008/120/EC describes the existing EU pig welfare legislation. The legislation was implemented into Irish law in Statutory Instrument (SI) 311 of the European Communities (Welfare of Farmed Animals) Regulations 2010. Excerpts of S.I. No. 311 specifically relating to pregnant gilts and sows are provided below.

Taken from section on accommodation for sows and for gilts after service

i. The owner or person in charge of a premises used for breeding, rearing or fattening pigs shall not confine, or cause or permit another person to confine, either a sow or a gilt after service unless the floor area available to each sow or gilt after service reared in a group is at least—

   (a) a minimum of 2.50 square metres for each sow in a group of sows or gilts if there are fewer than 6 pigs in the group,

   (b) a minimum of 2.25 square metres for each sow in a group of sows or gilts if there are more than 5 but fewer than 40 pigs in the group,

   (c) a minimum of 2.025 square metres for each sow in a group of sows or gilts if there are 40 or more pigs in the group,

   (d) a minimum of 1.81 square metres for each gilt after service if there are fewer than 6 pigs in the group,

   (e) a minimum of 1.64 square metres for each gilt after service if there are more than 5 but fewer than 40 pigs in the group, or

   (f) a minimum of 1.48 square metres for each gilt after service if there are 40 pigs or more in the group.

ii. A minimum floor area of at least—

   (a) 1.3 square metres for each pregnant sow, or

   (b) 0.95 square metres for each gilt after service,

shall comprise a continuous solid floor and no more than 15% of the floor area referred to in this paragraph shall consist of openings designed for drainage.

iii. The owner or person in charge of a premises used for breeding, rearing or fattening pigs shall not confine, or cause or permit another person to confine, either a sow or a gilt in the period commencing 28 days after service and ending 7 days before the expected date of farrowing other than in—

   (a) a group in a pen the sides of which are greater than 2.8 metres in length, or

   (b) a group in a pen the sides of which are greater than 2.4 metres in length if there are no more than five sows or gilts in the group.

iv. A person may keep a sow or gilt to which paragraph (iii) refers in an individual pen during the period mentioned in that paragraph if—

   (a) there are no more than 9 sows on the premises, and

   (b) the sow or gilt may turn easily in the pen

v. A person shall not tether or cause or permit another person to tether a sow or gilt.

Use of concrete slatted floors

vi. The owner or person in charge of a premises used for breeding, rearing or fattening pigs shall not keep, or cause or permit another person to keep, a pig on a concrete slatted floor unless—

(a) the maximum width of each opening is no more than—

(i) 11 millimetres in any floor where a piglet is kept,

(ii) 14 millimetres in any floor where a weaner is kept,

(iii) 18 millimetres in any floor where a rearing pig is kept, or

(iv) 20 millimetres in any floor where either a sow or a gilt after service is kept,

and

(b) the minimum width of each slat is at least-

(i) 50 millimetres in any floor where a piglet or weaner is kept, or

(ii) 80 millimetres in any floor where a rearing pig, a sow or a gilt after service is kept.

vii. A pig shall have permanent access to a sufficient quantity of suitable material, such as straw, hay, wood, peat or mushroom compost to enable proper investigation and manipulation activities, that does not compromise the health of the pig.

viii. Sows and gilts shall be provided with a diet that satisfies their nutritional needs and contains sufficient quantity of suitable bulky or high fibre food to satisfy their hunger and the need to chew and to ensure that they do not display signs of hunger.

(vii and viii are taken from section on specific provisions for various categories of pigs in S.I. 311)

2.2. DIFFERENCES BETWEEN THE EU MEMBER STATES

EU Directive 2008/120/EC describes the existing EU pig welfare legislation, and repeats the intention of the Commission to continuously review the legislation on the basis of scientific evidence. In anticipation of this review, the Dutch ministry of Agriculture, Nature and Food Quality asked Wageningen UR Livestock Research to describe the present situation regarding the translation of Directive 2008/120/EC into national legislation by the member states. The following differences between member states were extrapolated from that report (Mul et al., 2010: EU - Welfare legislation on pigs. Report 273 – Wageningen UR Livestock Research).

I. MINIMUM UNOBSTRUCTED FLOOR SPACE

EC Directive: 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 fewer than six 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%.

In Austria, Germany, Denmark, Sweden and The Netherlands, the minimum unobstructed floor space requirement per gilt is greater than that demanded in the EU legislation. The minimum unobstructed floor space is dependent on group size. In the Netherlands there are no extra demands for sows in groups as in Austria, Denmark and Sweden. Germany and Austria have only very limited extra demands (for example 2.5 instead of 2.475) and 2.05 instead of 2.025.

In Denmark the first10 gilts must have 1.90m^2 each, the subsequent gilts 1.70m^2 each and where there are 21 or more gilts they must have 1.50m^2 each. Similarly, the first to fourth sow requires 2.80m^2 each, the subsequent 6 sows 2.20m^2 each, the next 6 sows 2.00m^2 each and thereafter the requirements are the same as for the EC. Finally in the UK/Northern Ireland the area inside the free access/welfare stall cannot be included in the calculation of the minimum unobstructed floor space whereas it can be included in this calculation in Ireland.

II. CONTINUOUS SOLID FLOOR AND MAXIMUM DRAINAGE OPENING

EC Directive: For serviced gilts and pregnant sows: part of the area required, 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.

In Denmark the maximum allowable drainage openings is 10% although there is a transition period for existing buildings until July 1st 2013 for this and for continuous solid floor for individual crates for gilts and sows after service.

In the Netherlands the requirement for continuous solid floor space is greater for gilts (1.30m^2) and the maximum drainage opening is only 5%.

In Sweden there is a ban on fully slatted floors in all pig housing, drainage openings are not allowed.

III. GROUP HOUSING OF PREGNANT SOWS AND GILTS

EC Directive: Sows and gilts are kept in groups from four weeks after service to one week before the expected time of farrowing. The pen where the group is kept must have sides/walls/partitions greater than 2.8 m in length. When fewer than six individuals are kept in a group the pen where the group is kept must have sides greater than 2.4 m in length. By way of derogation from the first subparagraph, sows and gilts raised on holdings with fewer than 10 sows may be kept individually during the period mentioned in that subparagraph, provided they can turn around easily in their pens.

In the UK non lactating sows must be kept in groups and there is no exception for 4 weeks after service. In Sweden sows and gilts must always be housed in groups, except farrowing sows and sows one week before farrowing. In The Netherlands sows and gilts must be kept in groups starting from 4 days after service until one week before farrowing. Instead of 2.8m in Denmark the pen size has to be at least 3.0m in length.

IV. MANIPULABLE MATERIAL

EC Directive: Sows and gilts should have permanent access to manipulable material.

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

Sweden has an extra demand for nesting material for farrowing sows and gilts and demands that all pigs should have access to straw. In Denmark there is a specified demand for access to rooting material on the floor.

V. HIGH FIBRE/ HIGH ENERGY FOOD FOR DRY PREGNANT SOWS AND GILTS

EC Directive: All dry pregnant sows and gilts, in order to satisfy their hunger and given the need to chew, are given a sufficient quantity of bulky or high-fibre food as well as high-energy food.

Germany demands that dry pregnant sows and gilts are fed at least 8% dry matter or 200 grams high fibre. This demand is more specific than the EU regulation.

VI. SICK BAY FOR DISEASED AND INJURED PIGS

EC Directive: Pigs that have to be kept in groups, that are particularly aggressive, that have been attacked by other pigs or are sick or injured, may temporarily be kept in individual pens. In this case the individual pen used shall allow the animal to turn around easily if this is not in contradiction with specific veterinary advice.

Denmark has specific demands for sick bays for diseased animals or those requiring special attention (>2.8 m^2/ animal, minimum pen area: >3.5m^2 and total solid floor, 0.95 m^2/gilt and >1.3 m^2/sow).

2.3. IMPLICATIONS/FUTURE LEGISLATION

In EU Directive 2008/120/EC the Commission emphasised their intention to continuously review the legislation on the basis of new scientific evidence. In 2011 they directed The European Food Safety Authority (EFSA) to undertake a review of the recent literature on sow welfare focusing on the farrowing crate, space allowances during gestation and sow welfare in early pregnancy. This review is unlikely to have any immediate impact on existing welfare legislation regarding group housed sows. However, the growing evidence that space allowances greater than the minimum standards set down in the existing EU legislation contribute to welfare and performance improvements in group housed sows could mean that space allowances could be revised upwards in the distant future. There is still considerable inconsistency between reports on the effects of group housing sows on welfare and performance immediately after service.

CHAPTER 3

SOW BEHAVIOUR AND WELFARE

3. Sow behaviour and welfare

3.1 SOW BEHAVIOUR

(adapted from The Social Behaviour of Pigs by H.W. Gonyou; In: 'Social Behaviour in Farm Animals' Edited by L.J. Keeling and H.W. Gonyou 2001)

I. COMPOSITION AND STRUCTURE OF SOCIAL GROUPS OF WILD, FERAL AND FREE-RANGING PIGS

FIGURE 1. FREE RANGING WILD BOAR

While housing sows socially i.e. in groups, is not without welfare implications for sows, it is certainly closer to the natural life of these animals. Studies on wild, feral and free-ranging pigs reveal that the most common social grouping is that of several sows, their most recent litter and their juvenile offspring. Sows are closely related, either mother-daughter or sibling (full or half) groups and early associations between females often persist into adulthood. The number of sows in a group is likely to be dependent upon the availability of resources. Larger groups exist if food is plentiful but smaller groups are observed during times of sparse and widely dispersed resources.

II. USE OF SPACE

Families live within a distinct home range which can be as large as 100-500 ha although they generally return to a communal nest to sleep and maintain a distinct dunging zone 5-15m from nest. The natural habitat of such pigs is wood and scrubland which supports the foraging behaviour that occupies most of their waking hours. Pigs are opportunistic omnivores meaning that they will eat almost anything including roots, fruit, eggs and even small animals. The behaviour of free-living pigs is highly synchronised. This means that they tend to be active, forage, sleep and idle at the same times.

III. SOCIAL CHARACTERISTICS

Sows are dominant to all other group members but during the mating season when the boar joins the group he assumes dominance. Although sow-offspring groups exist in close proximity they always maintain the integrity of their social group meaning that unfamiliar animals are never allowed join the group. This trait is behind the problems that arise from mixing unfamiliar sows in confined group housing systems. Within free living sow-offspring groups sows form a dominance hierarchy (DH) (or 'pecking order') which governs priority of access to resources i.e. dominant or high ranking sows will have priority of access to a good feeding site over a subordinate or low ranking sow. In this way the DH acts as a group stabiliser whereby 'rules' are created that control social encounters. The DH is maintained by subordinate animals avoiding dominant animals rather

than by dominant sows attacking subordinate sows. This is based on a learned relationship that relies on the ability of pigs to recognise and remember each other. Indeed sows in very large social groups may have difficulty remembering the social status of all group members. This could explain why sows in very large groups form sub groups whereby they maintain cohesion with just a few specific individuals. The DH is unique which explains why it is 'upset' by the addition or removal of unfamiliar animals and pigs use aggression to re-establish a new one. Aggression and its consequences have negative welfare and performance implications for sows but these effects can be ameliorated by observing guidelines on mixing sows (See section 3.3).

3.2 WELFARE PROBLEMS ASSOCIATED WITH GROUP HOUSING

I) AGGRESSION

Most of the welfare problems for sows in group housing are caused either directly (e.g. skin lesions) or indirectly (e.g. lameness) by aggression. As already mentioned aggression is difficult to avoid when mixing unfamiliar animals because they have to fight to establish a DH. However, once the DH is established (within 24hours in most systems) it is possible to keep aggression to a minimum in very well designed and spacious group housing systems. Unfortunately in confined commercial settings low ranking sows rarely have enough space to avoid aggressive encounters or the opportunity to hide from higher ranking animals. These can experience severe aggression on a long term basis. Furthermore, in overstocked conditions sows cannot perform the appropriate behaviours to maintain a stable DH and levels of aggression remain steadily high. These situations are exacerbated where there is competition for access to resources such as food or lying areas. The subordinate or low ranking animals are the least well able to cope with such competition as they are often the smallest, youngest, thinnest and/or most compromised (e.g. lame) members of the group. Hence it is very important to consider how aggression will impact on the low ranking animals when making decisions on group housing.

The following factors influence aggression in group housing systems:

Sow factors

- *Position in dominance hierarchy (DH): high ranking sows are rarely the recipients of aggression but almost always initiate it*
- *Rearing environment: gilts reared in barren and/or overcrowded and therefore stressful environments are more aggressive in later life*
- *Physiological status (lactating, weaned, pregnant): lactating sows are the least and pregnant sows the most aggressive*
- *Genetics: leaner genotypes are more aggressive*

Housing factors (these are discussed in detail in Chapter 5)

- *Group size/composition*
- *Feeding system (competitive or not?)*
- *Diet (e.g. fibre content)*
- *Presence of manipulable substrates*
- *Flooring*
- *Pen size/space allowance*

II) LAMENESS

Lameness is characterised by abnormal gait and posture. Owing to its high prevalence and the fact that it is often associated with pain it is one of the most serious welfare concerns of a number of farm animal species. In pigs, lameness greatly increases the cost of production. Firstly, the productivity of a unit is reduced because an increase in the involuntary culling rate of sows is combined with the cost incurred in replacing them. Furthermore, there is a reduction in the number of pigs weaned per year because the average herd age decreases and replacement gilts yield fewer pigs per litter than sows and there is a reduction in the number of finisher pigs reaching the factory. It is therefore not surprising that a 1998 Dutch survey found that the highest economic losses were found in cases of culling for lameness/leg weakness.

In a survey on reasons for culling conducted by Teagasc in 1998, lameness accounted for at least 11% of all sow removals. This corresponds well with a figure of 15% of sows culled for lameness in the USA. However, it is likely that culling for lameness is underestimated by producers because animals that are culled for poor body condition or reproductive failure are often lame too. A recent study in the U.S. demonstrated that the reasons for culling have not changed much over the years with the primary reasons still being reproductive failure and lameness. In the 1998 Teagasc survey the highest percentage of animals culled for locomotor problems or lameness was in parity 1 animals. Similarly, research from the USA reports that 22.3% of young animals removed from the herd were culled for lameness problems which were second only to reproductive failure at 35.2%. Hence lameness is one of the main reasons for culling young sows and as such is a major driver of high replacement rates.

Early observations from a project on lameness at Moorepark are that there is widespread under appreciation of the extent of the problem of lameness in pigs of all ages and of its impact not alone on welfare but also on productivity and farm finances. Lameness causes considerable suffering in all classes of pigs but lameness in sows is particularly worrying as often the only 'treatment' is to cull her once she has farrowed. This means that lame sows suffer prolonged periods of pain and distress. This raises serious ethical issues as lameness is largely preventable and at the very least treatable. Furthermore, while lameness already contributes significantly to culling these figures are likely to escalate when the national sow herd moves to group housing. Features of most systems include minimal 'shared' space, competitive feeding systems and the absence of bedding (i.e. fully slatted flooring) all of which are major risk factors for lameness.

A. CAUSES OF LAMENESS

The main causes of lameness in sows are claw lesions, arthritis, osteochondrosis, structural / conformation defects and injury.

CLAW AND LIMB LESIONS/INJURY

While a high proportion of sows have at least one claw lesion present (between 96-99%), claw lesions only account for between 5-20% of lameness. The relationship between lameness and claw lesions may be dependent on the location and seriousness of the lesion. Some areas of the claw are more sensitive than others meaning that minor lesions may not result in pain and therefore not cause the animal to be lame.

One of the major causes of injuries to the claws (and limbs) is fighting on concrete/slatted flooring at mixing. Even after the dominance hierarchy is established sows will continue to fight if they are overstocked or have to compete for access to food (e.g. in long trough/floor feeding systems). Injuries to the claws (see Figure 2) and limbs commonly include partial or whole amputation of the dew claws, tearing of pre-existing areas of overgrowth in the heel or splitting of existing cracks in the weight bearing claws. In the absence of any treatment such injuries can become infected and in extreme cases lead to osteomyleitis (infection of the bone) and ultimately to death or culling.

FIGURE 2. EXAMPLES OF CLAW LESIONS LEADING TO LAMENESS

In 2011 Teagasc Walsh Fellow Ms. Julia Calderon Diaz recorded claw lesions in 85 multiparious (range parity 2-7; mean 3.26) crossbred Large White × Landrace sows in the Moorepark herd. Forty-two sows were housed individually in gestation stalls on concrete (1/3 slatted at rear) and 43 sows were housed loose in a single group and fed by an electronic sow feeder during pregnancy. Loose sows had solid concrete floored lying bays and fully slatted roaming areas. On day 110 of pregnancy sows were transferred to farrowing crates. The sows walking ability was scored on their way to the farrowing house with non-lame sows receiving scores of 0 or 1 and lame sows receiving scores of 2 or 3 according to severity. While sows were lying in the farrowing crate prior to farrowing their hind claws were inspected for claw lesions. These included 1) heel overgrowth and/or erosion (Heel eros); 2) heel sole crack (H/S crack); 3) white line (White L) damage; 4) wall cracks and 5) dew claw injuries. These claw lesions were scored from 0 (best) to 3 (worst) according to severity.

The findings of this research revealed that 100% of the sows inspected had at least one type of claw lesion and the majority had two or more types. Furthermore, while loose sows had more severe heel erosion and stall housed sows had more severe white line damage and dew claw injuries the severity of wall cracks and heel/sole cracks was similar between the two groups (Figure 3).

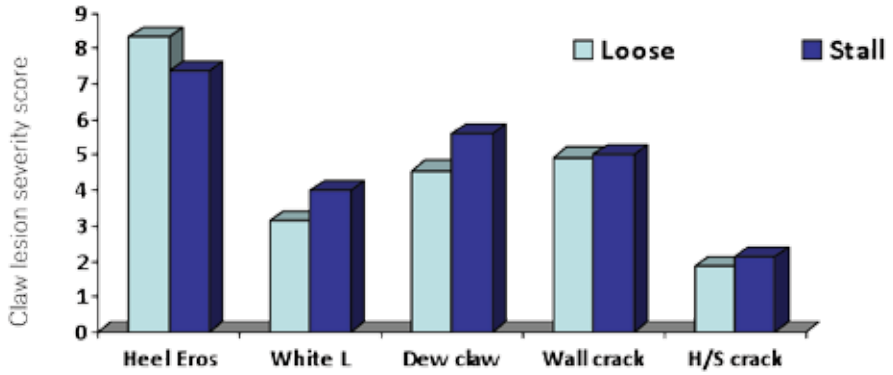

FIGURE 3. SEVERITY OF DIFFERENT CLAW LESIONS IN LOOSE AND STALL HOUSED SOWS FROM THE MOOREPARK HERD AT THE END OF PREGNANCY

However, the loose housed sows were 2.37 times more likely to be lame on transfer to the farrowing house than the stall housed sows. These findings support work done in the USA and other countries to show that even though both stall and loose housed sows have similar problems with claw lesions, these lesions are much more likely to cause lameness in sows that are group housed on concrete. This is because these animals fight and have to walk around for access to food and water and to dung etc. These findings support our concern that problems with lameness could escalate with the switch to group housing.

OSTEOCHONDROSIS

Osteochondrosis (OCD) is another major cause of lameness (and secondary degenerative joint disease or osteoarthritis) in pigs. OCD develops when areas of the growth cartilage (or growth 'plates' which are responsible for the growth of bones in length) experience restricted blood flow and die causing pain and lameness. Unlike the lesions seen in Figure 2, OCD is difficult to diagnose in live animals. During work for his PhD thesis Dr. William Ryan dissected the joints of cull sows from Moorepark and another commercial herd and reported a prevalence of OCD of almost 100%. Fighting by group housed sows at mixing and at feeding leads to slips, trips and falls on concrete. While such trauma is unlikely to cause the initial development of OCD it can cause subclinical lesions to develop into clinical lesions and consequently to cause lameness.

B. IMPACT OF LAMENESS ON ENERGY USAGE AND SOW PERFORMANCE

In a high proportion of lame sows internal infectious and inflammatory responses (i.e. the immune system) associated with pain will be activated. Activation of the immune system is very costly in terms of energy. Furthermore, it changes amino acid metabolism and the sow's amino acid requirements with proline and phenylalanine becoming more important than lysine. This explains why a lame sow could consume the same amount as a non lame sow but be in poorer body condition. She is simply not utilising the nutrients consumed properly or efficiently. Furthermore, products of the inflammatory response such as cytokines are not only involved in connective tissue degradation which exacerbates the lameness problem but also disrupt the hormones controlling reproduction leading to poor fertility. This is why lame sows produce at least 1.5 fewer piglets than sound sows. Poor mobility caused by lameness not only results in reduced lactation feed intake but increases the likelihood of piglets being crushed. Indeed piglet losses due to crushing by lame sows are 15% higher than from sound animals.

Finally, there is an interesting relationship between lameness and shoulder ulcers which is stronger than the more commonly understood link between poor body condition and shoulder sores. While sows with body condition scores of 2 or less have a 3.5 times greater risk of shoulder ulcers, lame sows have a 3.7 times greater risk of having shoulder ulcers than non-lame sows.

C. CONSIDERING LAMENESS WHEN MAKING DECISIONS ON GROUP HOUSING

Output per sow is one of the main performance indicators we consider when evaluating a unit or making comparisons between different housing/management systems. However, problems with lameness can be masked by good herd performance figures. Sows in high performing herds are actually at greater risk of lameness than sows in herds with poorer performance. Lameness is one of the main reasons for culling young sows and a major driver of high replacement rates. Therefore these indicators better reflect the extent of the lameness problem on a farm. Indeed, it would be wise for those of us trying to make a decision on group housing to refocus our evaluations on these indicators rather than on output per sow. As low replacement rates are integral to the profitability of a production system and the highest annual production is achieved when sows are removed due to 'old age' (i.e. ≥ 5 parities) tackling the problem of lameness in sows offers huge benefits.

D. LAMENESS DETECTION

Awareness is the first step in addressing the problem of lameness. This has to start with an assessment of reasons for culling sows, and sow replacement and mortality rates. It can also help to note whether sows being culled for reproductive/poor performance are also lame and to start keeping track of the number of sows you see with missing dew claws and external abscesses on their limbs. The farrowing house is a good place for this.

Lameness is much easier to identify in group compared to individually (i.e. stall) housed sows. Provided that gilts/sows are not overstocked clinical (i.e. severe) lameness is relatively easy to detect in any group system but especially those in which sows are fed simultaneously at specific times of the day. In such systems, sows are usually observed during feeding and animals that don't stand up or that have obvious difficulty moving to the trough at the point of feed delivery are clearly visible. However, detecting sows in the earlier stages of lameness at which time they are more likely to respond to treatment requires a more specific protocol lameness or locomotion scoring system. Visual locomotion scoring systems take the speed of walking and indications of asymmetry such as step length, head and hindquarter movements, willingness to walk and contact between the feet and the floor into account. They do not give any information as to the cause of lameness. Animals suspected of being lame should be singled out from the group and observed in good light moving about on a clean, dry and level surface.

A simple scoring system involves a three point scale where no lameness = 0, mildly lame = 1 and clearly lame = 2. A mildly lame animal moves freely from one location to another but has an abnormal gait and a clearly lame sow needs encouragement to move. A more comprehensive lameness scoring system is shown in Figure 4. It is important to remember that lame sows will tend to move better immediately after weaning when their body condition is lighter so this is not a good time to diagnose lameness in the sow herd.

Lameness Score	0	1	2	3	4	5
Initial response to human	Bright, alert and responsive	Bright, alert and responsive	Bright, alert and responsive	Bright, less responsive	May be dull (only rises if strongly motivated)	Dull and unresponsive
Pig's response after opening gate	Inquisitive, will tentatively leave pen	Inquisitive, will tentatively leave pen	Inquisitive, will tentatively leave pen	Often last to leave pen	Unwilling to leave familiar environment	No response
Behaviour of individual within group	Freely participates in group activity	Freely participates in group activity	May show mild apprehension to boisterous pigs	May show mild apprehension to boisterous pigs	Will try to remain separate from others within groups	May appear distressed by other pigs in the group but unable to respond
Standing posture	Pigs stands squarely on all four legs	Pigs stands squarely on all four legs	Uneven posture	Uneven posture. Will not bear weight on affected limb (i.e. standing on toes)	Affected limb elevated off floor (pig appears visibly distressed)	Will not stand unaided
Gait/walking ability	Even strides: Caudal body sways slightly while walking. Pig is able to accelerate and change direction rapidly	Abnormal stride length: (not easily identified) Movement no longer fluid: pig appears stiff. Pig still able to accelerate and change direction	Shortened stride. Lameness detected. Swagger of caudal body while walking. No hindrance in pig's agility	Pig may not place affected limb on the floor while moving	Shortened stride. Min weight bearing on affected limb. Swagger of caudal body while walking. Will still trot and gallop.	Does not move

FIGURE 4. PROTOCOL FOR LAMENESS DETECTION AND SCORING IN PIGS (ADAPTED FROM MAIN, CLEGG, SPATZ AND GREEN 2000. VETERINARY RECORD 147, 574-576)

E. LAMENESS PREVENTION

Clearly there are very good reasons why we should try to prevent lameness in sows. This is complicated by the fact that lameness is a multifactorial problem with genetic, mechanical, chemical and biological processes involved. However, the majority of sows are affected by claw lesions and the risk factors for these are well understood. For example improvements can be made to the housing environment such as replacing damaged slats and to management by ensuring that gilts have good conformation at selection and mixing them in specialised pens to protect the feet. However, two less well known, but essential factors in the prevention of claw lesions is a claw care/trimming program and supplementing the diet with trace minerals.

CLAW TRIMMING

Incorporating routine foot inspections into the management program for breeding sows is the first step in addressing claw lesions. This will enable you to become familiar with different types of claw lesions and the anatomy of the foot. Routine inspections will also mean that the lesions can be monitored such that intervention happens early rather than later to prevent lameness occurring. The best time to do this is when sows are being moved from the gestation to the farrowing accommodation. The ultimate goal should be to incorporate corrective claw trimming into the management program for breeding sows. Several companies have designed a mechanical chute which keeps the sow comfortable and calm as her four feet are lifted off the floor where they are easily accessible for examination and trimming (Figure 5). It would be possible to construct a modified version of this chute on farms. If a chute is not available it is also possible to at least trim the length of overgrown claws using a nippers while sows are lying in the farrowing crate.

FIGURE 5. CHUTE FOR LIFTING SOWS TO INSPECT/TRIM CLAWS

Rates of hoof horn growth and wear in different environments and at different physiological stages are well established for dairy cows. Recent work on sow claws reveals similar patterns. Essentially the rate of growth and wear is greater for the hind compared to the front claws. Compensatory growth occurs with higher rates of wear such as occurs during the first few days after re-mixing group housed sows when sows fight to establish a dominance hierarchy. Furthermore, the front claws are generally more balanced than the hind claws in that there is less discrepancy in size between the lateral (outside) and medial (inner) claw so they require less frequent trimming. The objective of trimming is to restore balanced weight bearing within and between claws to reduce the risk of claw lesions. However it should not be undertaken without training or at the very least good knowledge of the functional morphology and biomechanics of the claw.

BOX 1

Guide to claw trimming

Equipment needed: angle grinder with a very coarse sand disc, a pair of hoof nippers and a sharp hoof knife

STEP 1: TRIM THE TOES

Use nippers to reduce toe length. Do this in several increments, inspecting the end of the toe after each cut to determine if another cut can be done safely.

The ideal toe length is about 50 mm.

With some sows, there may be one overgrown toe on the foot, and one very short (stunted) toe. In these cases, you may not be able to reduce the long toe to match the length of the short toe

STEP 2: STRAIGHTEN THE WALL

Toe overgrowth often curves or buckles the dorsal wall, making it concave

Use the angle grinder to straighten the wall by removing excess wall horn below the area where buckling occurs

The wall should be straight from the coronary band to the bearing surface

STEP 3: BALANCE THE SOLE AND HEEL

Use the grinder to reduce the sole depth. The objective is to have a flat and level sole area across both claws for functional weight bearing of the foot

It is common for the outside claw to be more overgrown than the inside claw, so the lateral claw will need more sole horn removed. The medial claw often only needs flattening, with minimal sole horn removal

If the heel is overgrown, remove soft tissue with the grinder or hoof knife. The outside heel is often more overgrown than the inside heel, but with care these can be made even (except in cases where the inside heel is small and underdeveloped)

The heel should not be trimmed all the way flat to match the sole, as it acts as a 'first impact' shock absorber when the sow walks

STEP 4: TRIM DEW CLAWS

Overgrown dew claws are prone to amputation and can interfere with normal locomotion of the sow

An ideal dew claw horn should be approximately 20 mm long

Use the nippers to reduce dew claw length. Do this in increments until a satisfactory length is obtained

Use the angle grinder to round off the end of dew claws

Caution: *Do not draw blood from the claw when trimming. If you draw blood, you have trimmed too aggressively and have penetrated the corium. It is better to leave a little extra horn than to remove too much.*

FEED TRACE MINERALS

Research in North America shows that sows in a highly prolific herd maintained mineral stores across 7 parities. This is also likely to be the case in Europe where feeding regimes are even better matched to requirements. Nevertheless nutrition is vital in developing the hoof structure and the importance of the trace minerals manganese, zinc and copper in the keratinisation process is well known. Hence, supplementing the diet with additional trace minerals could help to prevent lameness caused by claw lesions. Research from the University of Minnesota showed that sows fed a diet iso-substituted with complexed trace minerals (CTM) had lower total claw lesion scores and a lower proportion of lame sows compared to sows fed inorganic trace minerals. Interestingly sows fed CTM also had more piglets born alive compared to sows fed inorganic trace minerals (11.07 vs. 10.44 piglets per litter).

Biotin is another essential component of hoof health. However, if biotin levels are too high the claws can become overgrown. It is best to check biotin levels in the sow diet with your nutritionist on a regular basis.

INCORPORATE A LIME BOX IN THE ESF STATION

Dutch vets recommend putting a tray filled with dry lime (seek veterinary advice) into the ESF station (Figure 6) for sows to stand in while eating. The lime dries out and disinfects the feet every time the sow enters the station and this could help to prevent lameness.

FIGURE 6. LIME FILLED TRAY INSIDE FEEDING STATION

F. TREATMENT OF LAME SOWS

Prevention is clearly better than cure but where sows become lame they can recover with appropriate care and treatment. Unfortunately this is lacking on many units where often the only 'treatment' is to cull and too less often, to euthanize, the affected animal. We forget the tremendous investment of money, time and resources that are associated with bringing a replacement female into the herd. It may make better economical sense to try and keep a lame sow with good performance records in the herd by treating her rather than to introduce a young and unproven gilt in her place.

BOX 2

Treatment of lame sows

Lame sows and especially those with claw injuries (e.g. dew claw amputation) should be kept in a solid floored, bedded or rubber mat covered recovery pen where they do not have to compete for food and water

Treat sows with anti-inflammatory drugs and broad-spectrum antibiotics to improve chances of recovery

Lame sows should also be given analgesics (pain killers); the pain relief they provide encourages sows to get up and walk around and to eat and drink thereby speeding up their recovery

The surface of exposed, cleaned lesions may be sprayed with antibiotic, e.g. tetracycline or dusted with an antibiotic wound powder

Culling should not be delayed for sows that do not recover following the treatment outlined above

Sows that have great difficulty walking or that are clearly in a lot of pain should not be sent for slaughter and instead euthanised as soon as possible

III) STRESS

Aggression caused by re-mixing is a major stressor of pigs. In remixed growing pigs this stress causes a reduction in growth performance for 2-4 weeks. Heart rate increases and blood/salivary cortisol levels rise in response to the stress of mixing and sows can be visibly distressed (i.e. panting and restless). Provided that stable groups are not overcrowded the dominance hierarchy (DH) is generally established within 24 hours and both the physiological parameters and the sows behaviour return to normal levels. However, social stress caused by aggression can continue throughout gestation if sows are overcrowded, have to fight for access to food or for places to lie. In addition, where the DH is constantly changing as served sows enter and farrowing sows leave as in dynamic groups, sows may experience chronic stress. The degree to which sows experience the effects of social stress will be influenced by their position in the DH. Low ranking sows in the group usually experience the effects of social stress (chronically elevated heart rate and cortisol levels and weight loss) more than animals higher in the DH. Indeed threats and visual contact can be enough to cause stress in low ranking animals.

IV) POOR BODY CONDITION

Ultimately long term or chronic stress deteriorates immune function and contributes to performance and health problems in sows. Particularly, in low ranking animals, the effects of stress are mediated by high levels of fear causing a reduction in food intake rather than directly by aggression. This is why poor body condition (often combined with lameness) is often the first sign that an animal is struggling in a group system. Electronic sow feeding stations are the only way of guaranteeing individual rationing of sows in group systems. However, free access stalls (Figure 7) do at least ensure that even low ranking sows are protected and therefore can feel secure while feeding. In long trough and floor feeding systems there is competition for access to feed leading to variation in body condition within the group. The risk of reproductive failure brought about by poor body condition in the low ranking animals is much higher in such systems.

FIGURE 7. GROUP HOUSED SOWS FEEDING IN FULL-LENGTH FREE-ACCESS ('WELFARE') STALLS

V) SKIN AND VULVA LESIONS

FIGURE 8. VULVA AND SKIN LESIONS CAUSED BY AGGRESSION

Vulva and skin lesions caused by aggression represent a serious threat to the welfare of sows in group housing. The larger size and heavier weight of sows means that they inflict more skin damage on one another while fighting compared to younger pigs. However, skin lesions in particular can be a valuable management tool for monitoring the amount of aggression and therefore social stress in groups of sows. Generally levels of skin damage will decrease during the first week after mixing. Where skin damage remains persistently high for longer this is a clear indication that there is either too much aggression for access to feed or that the sows are overcrowded etc. and remedial action can be taken.

Vulva lesions used to be a problem with older electronic sow feeding (ESF) stations where sows had to reverse out after feeding or where sows were forced to queue in confined spaces while waiting to enter for feed. With newer ESF station designs and our better understanding of the requirements for optimal layout of ESF houses, vulva lesions are rarely a problem. However, vulva lesions are regularly observed in sows kept in pens with troughs on both sides of the pen and without any trough divisions, particularly if the sows are fed a dry diet. This feeding arrangement should be avoided as levels of aggression at feeding are very high.

3.3 GUIDELINES ON MIXING SOWS AND MINIMISING AGGRESSION

Given that many of the welfare problems associated with group housing relate to fighting between sows at mixing it is important that guidelines on mixing sows to protect health and welfare are followed. A suggested space allowance of 3.5m^2 (37½ sq. ft) per sow is required to ensure appropriate sow behaviour at mixing. The distance required for a sow to escape a higher ranking individual following a fight is crucial to the rapid development of a stable dominance hierarchy. In scientific studies where sows were mixed in very large pens, some sows were pursued over 20m during fights. As it is rarely possible to give sows this much space to flee from attackers in commercial settings, barriers should be provided for sows to hide behind and protect themselves. Welfare stalls serve this purpose but ideally barriers should be flexible e.g. bales or a suspended rubber partition. It is important to ensure that there are no sharp edges or protuberances in the pen. If possible, the floor should be covered with mats or straw to protect the feet during fighting. If sows must be mixed on slatted floors there should be no large gaps between the slats and the void edges should not be jagged or broken. It is important to observe SI 311 on maximum void openings (20mm) and minimum slat widths (80mm) although even wider slats (120mm) are better.

In many group housing systems the above criteria will be difficult to achieve so there are strong arguments for the use of specialised mixing pens. In such pens sows can fight to establish a dominance hierarchy/pecking order in much more safety than in conventional pens. Once the pecking order has been established the group is then transferred into more conventional pens for the duration of pregnancy.

BOX 3

Design specifications for specialised mixing pens

Rectangular or round pen allowing flight distances of 10-12m

Central flexible barrier around which sows can easily pass each other

Minimum space allowance of 3.5m^2 (37½ sq. ft) per sow

Solid flooring with straw bedding

Pen fixtures well protected to minimise the risk of injury

Ad-lib feeding

Pen size matched to group size in the main dry sow housing system

Sows left in mixing pens for 24-36hrs

I. WHEN TO MIX?

Sows are at their most vulnerable at weaning as their body condition is often at its poorest, they may have sustained injuries in the farrowing crate and they are unsure on their feet following 4 weeks of close confinement on slatted flooring. Hence the severity of aggression at weaning tends to be lowest compared to other times. Furthermore, weaned sows being lighter cannot inflict such severe damage on one another. Mixing sows 2 days post service is not a problem from the point of view of reproductive performance although the sows will have recuperated slightly from the stresses of lactation and may engage in more severe aggression. Sows certainly should not be mixed between 5 and 25 days post service as this is when implantation occurs. Sows mixed at 28 days post service are past the crucial stage of implantation. Nevertheless the consequences of aggression at this stage are serious as sows that have recuperated from the stress of lactation and re-gained bodyweight fight at a high intensity. Hence there is still a risk of reproductive failure particularly if the housing system is inadequate (i.e. no hide areas, minimal shared space). It might

be worth considering the following strategy:

1. Mix sows at weaning; give them enough time to form a stable dominance hierarchy
2. Move sows into stalls for service 2-3 days later
3. Re-mix sows into the same groups 28 days after service

The sows will be able to remember the dominance hierarchy that was formed at weaning. This means that there will be fewer and less intensive fights at the second re-mixing (when the sows are pregnant) compared to if they were being introduced to one another for the first time.

Sows may fight less if mixed in the evening. However, it is more important that mixing is supervised so if no one is available to supervise mixing in the evening it should be done during the day.

II. OTHER CONSIDERATIONS

It is advisable to mix sows after feeding during their last day in the stalls (i.e. from c. 27 days post service) and to provide ad lib feed in the gestation house for the first day/until the dominance hierarchy is established (signified by a reduction in fighting). Thereafter a high fibre diet and/or foraging substrates can play a part in keeping levels of aggression low. Tranquillisers and masking sprays are of limited use and may even delay the formation of a pecking order. Ultimately it is vital that re-mixing is kept to a minimum. If possible re-mix sows into their original group post weaning.

III. IMPORTANCE OF SUB-GROUP FORMATION IN REDUCING AGGRESSION IN DYNAMIC GROUPS

Introducing individual sows or gilts to the main resident group of sows in large dynamic groups is a sure way to escalate aggression and all of the problems associated with it (stress, lameness and reproductive failure etc.). Levels of aggression are much lower in dynamic groups if the sows to be newly introduced to the resident group are firstly allowed to form a sub-group. Forming sub-groups prior to introducing sows to the resident sows strengthens sub-group behaviour. This means that aggression between sub-group members and the resident sows will be much lower during the first week after the sub-group has been introduced compared to if the sows were introduced singly (see Box 4 for more information).

BOX 4

Introduction of sub-groups into large dynamic groups

The weekly sub-group should be allowed to establish a dominance hierarchy (pecking order) before being added to the main group

Ideally they would be pre-mixed in a specialised mixing pen where they remain for 2-3 days prior to being introduced to the main herd

The size of the sub-group should be approx. 5-10% of the size of the resident group with not less than 3 animals (and preferably not less than 5)

Break up the lying area in the main pen into smaller sections using partitions; this allows sub-groups to stay together and away from the resident sows, thereby reducing aggression

Consider penning the sub-group in an area of the main pen prior to introducing them to the resident sows; this can help them establish their own territory

Herd performance is likely to be better where sub-groups are mixed into the main group at least 5 weeks after service, i.e. after implantation is complete.

Gilts and small sows can have difficulty competing within a large dynamic group and are sometimes housed separately; however, in the case of gilts this can simply postpone the problem of assimilating into the herd until the 2nd parity

Separate very aggressive sows; some are simply not fit for living in groups

CHAPTER 4

STATE OF PREPARATION FOR 2013 AND EXPERIENCES OF GROUP HOUSING IN OTHER EU COUNTRIES

4. State of preparation for 2013 and experiences with group housing in other EU countries

4.1 INTRODUCTION

In July 2011, the EU Commission requested information from all Member States about their progress towards the implementation of group housing of sows. The Commission also asked Member States to set out their national action plans to address any non-compliance. In mid-March 2012, the Commission revealed that three Member States had confirmed that they were already compliant. These were Luxembourg, Sweden and the United Kingdom. Nine other Member States stated that all of their producers would be fully compliant by the end of 2012.

A further seven Member States stated that over 90 per cent of their producers would comply with the regulations. Five others said that between 70 and 89 per cent of producers would be compliant. The other three Member States were unable to provide an estimate of their level of compliance but only between 28 and 55-60 per cent of their producers already met the required standards.

At the same meeting, the Commission confirmed that it was using all the tools available to it to push Member States to comply with the legislation. Enforcement action could not begin until January 2013, since producers would not be in breach of the regulations until then. Amongst the measures being taken were: training of official veterinarians, audits by the Food & Veterinary Office, preparatory work to launch infringement procedures and provision of financial support.

In the following sections we describe current compliancy with the EU legislation on group housing in a selection of member states and where they expect to be by January 2013. We also describe some of the systems in use in these countries and where available their experiences thus far with group housing.

4.2 DENMARK

In Denmark an estimated 75 per cent of sows were in group housing at the end of 2011. Further progress is expected to result in full compliance by the end of 2012, with some producers exiting the industry in the meantime.

The following group housing systems are common in Denmark:

- Stable groups; slatted and solid floor
  - *Wet feed in a long trough*
  - *Drop/dump feeding*
  - *Trickle feeding*
  - *Opti pens – combination of individual stalls and long trough for feeding (see below)*
- Stable or dynamic groups
  - *Individual stalls; small nest areas with deep litter and slatted floor between stalls (T and L pens – see photo below)*
  - *ESF; deep litter and slatted floor around ESF*
  - *ESF; small bedded 'nest' (lying) areas and large areas of slatted floors*
  - *ESF; large bedded 'nest' areas and slatted floors*

THE DANISH OPTI PEN GROUP HOUSING SYSTEM

The features of the Opti pen design includes: feeding/resting stalls, a large (bedded) lying area with feeding trough on one side and a large space allowance (2.7 to 3.3m^2/sow) (Figure 9). It uses less space than if feeding stalls were provided for all sows and is competitive re. space with ESF systems (remember that the Danes allow a more generous space allowance per sow than required by the EU).

FIGURE 9. DANISH OPTI PEN FOR PREGNANT SOWS

It is recommended to feed a dry diet so that all sows can be fed simultaneously. However research on wet feeding in the Opti pen system has also been conducted. Results showed that the choice of feed system was linked to age with older sows being more loyal to a particular system and younger sows being less selective. Older/high ranking sows tended to choose the feeding stalls as the feeding cycle often started here the result being calmer feeding at the long trough by the low ranking/young sows. The choice of feeding place by dominant sows is probably determined by where feeding cycle starts.

T AND L PENS

These pens have two rows of self closing stalls that are wide enough both for feeding and lying with a slatted passage (≥3m wide) in between. What differentiates them from similar systems in Ireland and The Netherlands is that an additional communal area is provided at the end of either one ('L' pens) or both ('T' pens) rows of stalls (Figure 10).

FIGURE 10. DANISH T PENS

T and L pens give sows the option of lying in the stalls or in the communal loose area. Here the openings comprise no more than 10% of the floor (stricter than the EU's 15%) or else the floor is 100% solid and bedding is provided.

FOCUS ON LAMENESS

At a recent conference in Spain Hans Aae, Head of Nutrition at Vitfoss gave the following reasons for increasing their focus on lameness in sows in Danish herds:

- As the number of herds operating group housing increased lameness in sows became more of a problem
- In Denmark it is a criminal offence to send a lame sow for slaughter
- This resulted in a huge increase in on-farm mortality of sows due to euthanasia
- Aside from this, on-farm sow mortality rates were too high
- The number of litters per sow per lifetime was too low
- Replacement rate of young sows in group systems was too high

According to Mr. Aae it is essential that different types of claw lesions (e.g. dew claw amputation, heel erosion) are documented so that the cause can be identified. In order to detect early signs of lameness before it has a negative impact on performance or results in premature culling, the locomotory ability of sows should be scored. Furthermore group housed sows should be supplemented with the minerals copper, zinc and manganese and biotin to promote good claw structure and strength.

4.3 THE NETHERLANDS

Research in the Netherlands shows that by the end of 2011 just over half of farms had converted fully to group housing. A further quarter of farms were already partly converted. Between them these farms housed just over 70% of Dutch sows. It is expected that 12% of farms (7% of the sows) will end their sow-operation in 2012. By the end of 2012, around 90 per cent of remaining farms (with 90 per cent of sows) will be converted. Of the remaining 10% of farms poor financial situation, problems with licensing, plans to move to another location and simple indecision were given as reasons as to why they will not be in compliance with the legislation in 2013.

FIGURE 11. INDIVIDUAL FEEDING/LYING STALLS WITH FULLY SLATTED ALLEY

In the NL the following systems are currently in use:

- 34% of the farms: individual stalls with an alley (Figure 11)
- 32% of the farms: ESF and concrete flooring
- 15% of the farms: ESF and straw bedding
- >750 sows per unit: 49% have individual stalls with an alley

Producers planning on converting in 2012 will use:

- Individual stalls with an alley (53%)
- Floor feeding (12%)
- ESF with concrete flooring or straw bedding (5%) (Figure 12)

FIGURE 12. LARGE DYNAMIC GROUP ON STRAW AND FED BY ESF

WHY THE MOVE AWAY FROM ESF?

What is obvious from the above is that a much smaller proportion of Dutch producers are planning on installing ESF systems compared to what is currently in use by the industry. In the Netherlands the small to medium-sized producers made the conversion to group housing at a much earlier stage than the larger sow-operations. Many of these producers installed ESF systems because they could be easily and relatively cheaply incorporated into existing buildings. However, this meant that compromises were made in terms of positioning the ESF and the placement of lying areas etc. This combined with poor knowledge of how to manage sows in large groups and the fact that the early ESF systems were not as technically advanced as the ones available nowadays meant that the system earned a poor reputation that has proved difficult to change. The current situation in NL is that while 68% of the units with just over 750 sows (57% of the sows) have fully group housed sows very few of the much larger units (>1500 sows) have converted to group housing. These are much more likely to choose individual crates with a walking alley because of the similarity with the system they already know and the lower requirement for skilled employees.

FACTORS FOR SUCCESS IN DUTCH GROUP HOUSING SYSTEMS

Research conducted at Wageningen UR (report 283) investigated the factors for success in Dutch group housing systems. 700 pig producers were interviewed. Results revealed variation in farrowing rate from 70 to 95%, on average the farrowing rate in group systems was 87% with the top 10% of units achieving a farrowing rate of 91% (Table 1). The work also showed that farrowing rate was independent of time after AI when sows were moved to the gestation unit. However it must be remembered that in NL this can be no longer than 4 days after service. Most importantly housing system had no effect on farrowing rate.

The critical success factors identified for good reproduction and welfare results for sows in all group housing systems were as follows:

1. Animal-directed approach i.e. good empathy towards animals
2. Good management-skills of farmer and his personnel
3. Good system of raising gilts (management, housing and nutrition)

The type of group-housing system was NOT identified as a critical factor for success in group housing. This emphasises that good results can be achieved with any type of group housing system provided that the 3 success factors identified above are in place.

TABLE 1. PERFORMANCE OF DUTCH SOWS IN 'AVERAGE' UNITS AND IN THE TOP 10% OF UNITS

	Average of Topigs units	10% Best Units
Average no. of sows/unit	449	561
No. litters per sow per year	2.4	2.46
No. weaned piglets per sow per year	28.1	30.9
No. liveborn piglets per litter	13.4	14.1
Prewean mortality, %	11.9	10.4
No. weaned piglets per litter	11.8	12.6
Interval weaning – insemination (days)	5.5	5.3
Farrowing rate (%)	88	91

On the 10 best farms a higher proportion of the sows were in good body condition and they received higher (better) scores for their behaviour towards humans and other sows (i.e. there was less aggression). Most importantly sows on the 10 best farms had a higher space allowance than sows on the 10 worst farms (Table 2).

TABLE 2. PROPORTION OF SOWS IN OPTIMAL BODY CONDITION, MEAN SPACE ALLOWANCE PER SOW AND SOCIAL BEHAVIOUR SCORES FOR GROUP HOUSED SOWS IN THE 10 BEST AND 10 WORST FARMS*

**of 70 farms operating group housing with sows mixed into groups <4 days after AI*

	10 worst farms	10 best farms
Body-condition management	36%	57%
m^2 per sow during gestation	2.1 m^2	2.5 m^2
Social behaviour of the sows (also towards humans) (scoring 0-5)	3.5	4.4

Environmental impact and therefore ease of getting a licence as well as sow welfare and therefore public acceptance were best in systems in which sows were managed in dynamic ESF groups on straw (Table 3). However, this system ranked worst from the point of view of the farmer probably because of the increased labour associated with the use of straw. Individual stalls and alley ranked best from the point of view of economics and for the farmer probably because of the similarity of this system to individual stalls and the lower requirement for high stockmanship skills. Nevertheless this system ranked worst from the point of view of public acceptance. Indeed there are concerns that this system may eventually be banned in NL because it is too easy to keep sows locked into the stalls (M. Schuttert – Presentation on group housing in NL at Zinpro conference, Barcelona, Spain 9th March 2012). The welfare of sows on concrete and fed by ESF was ranked better in static compared to dynamic groups. This is related to the continuous disruption of the social hierarchy associated with dynamic group systems meaning that sows must continuously fight on concrete flooring. Ms. Schuttert concluded her presentation by saying that with group housing there is no technical solution to poor management and stockmanship.

TABLE 3. RATING OF DIFFERENT ASPECTS OF FOUR GROUP HOUSING SYSTEMS

	ESF, stable group, mech. climate control	ESF, dynamic group, straw	ESF, dynamic group, concrete	Individual stalls with alley
Farmer	+	-	+/-	++
Sow welfare	+	++	+/-	+/-
Animal health	+	+/-	+/-	+/-
Environment	+/-	+	+/-	+/-
Economics	+	+/-	+/-	++
Public acceptance	+/-	++	+/-	-
Ease of getting a licence	+/-	+	+/-	+/-

++ excellent + good +/- moderate - bad

4.4 GERMANY

There are almost no formal statistics on the situation regarding group housing in Germany. However, it is thought that about half of breeding farms were compliant at the end of 2011 but that the percentage was significantly higher in the main livestock regions. This means that up to 70 per cent of sows were group housed. Many of the remaining non-compliant farms, particularly the smaller operations, are likely to give up piglet production. Near full compliance is expected in the major producing regions but there may still be some non-compliant small farms in the south of the country.

4.5 SPAIN

A survey of the larger commercial producers in Spain showed that just under half were compliant in the summer of 2011 with most of the rest expecting to have converted by the end of 2012. However, the level of compliance is thought to be much lower amongst smaller producers. For example, for those included in the survey who had less than 400 sows, compliance was only 16 per cent with a further 21 per cent expecting to be ready for 2013.

BOX 5

Observations on a Spanish farm with group housing

In March 2012 four members of the Pig Development Department visited the Albesa-Ramadera project in Lleirda Spain. The farm is operated by the consultancy group Optimal Pork Production (OPP). OPP were established in 1996 and comprising of vets and nutritionists they offer an interdisciplinary approach to pig consultancy. Their sister company, Infoporc advises and sells pig equipment. Currently more than 300 farms in Spain have been converted or constructed under the supervision of both companies.

This level of expertise led to the development of the P plus farm at Albesa-Ramadera in 2009. Features include:

- 3200 sows; produces weaned piglets
- Two 4,049 sq. metre barns dedicated to gestation and service and in compliance with European welfare legislation
- Two 2,933 sq. metre farrowing houses with full plastic floors
- One 948 sq. metre barn for gilt acclimatisation and training
- 1 manager, 4 section managers, 1 technician and 4 stockpersons

Over time OPP has adapted the animal welfare laws in Spain and chose to take what they refer to as a Technical Animal Welfare approach for the Albesa-Ramadera project. As the name suggests this involves a highly mechanised/computerised system which focused on the use of electronic transponders and feeding stations for the pregnant sows. Similar to Teagasc Moorepark they installed Schauer electronic sow feeding (ESF) stations. Sows are held in large groups of approximately 160 and fed by two ESF stations. From a management point of view the stations appeared to be working well and all gilts were well trained on the stations. However the stockmen didn't appear to be quite so well trained. In most of the stations there was a build up of stale feed which is purely a consequence of inattention on the stock people's behalf.

The houses were well ventilated and well designed except that the sows were dirtying the solid floored lying bays. Our guide suggested that this was because of the unseasonably cold weather in the previous two weeks. Staff also mentioned that the lying bays were not cleaned throughout the entire gestation. There were other problems associated with such large groups; sows were missed for farrowing and it seemed to be very challenging to health check the animals.

Overall the project at Albesa-Ramadera was impressive and they have made big advances in satisfying European welfare legislation in Spain. However, it was clear that even the most up to date technology could not compensate for poor stockmanship. Ultimately well trained stockpersons will play a much more important role in the success of group housing systems than technology.

CHAPTER 5

GROUP HOUSING – DESIGN DECISIONS

5. Group housing – design decisions

In the following sections information is provided on the various features of the housing environment that will influence design decisions for group housing systems. One of the most important decisions to be made is on the choice of feeding system which will be closely linked to the decision on whether to opt for static or dynamic groups.

FIGURE 13. GROUP HOUSED SOWS

5.1 NUMBER OF GROUP SPACES REQUIRED

Sows may be kept in stalls from weaning until 28 days after the effective mating, and in farrowing crates for one week before farrowing until weaning. This amounts, in total to approximately 82 days per cycle of approximately 155 days (=2.35 litters per sow per year). The percentage of sows in the herd required to be kept in groups is then 53% of the herd size as shown in Table 4. Allowing for some incomplete occupancy of pens and to allow moving of sows and cleaning/ washing, group spaces are required for c. 58% of the herd i.e. the 53% above plus 5% (one week's matings).

TABLE 4. DISTRIBUTION OF SOWS IN HERD BY REPRODUCTIVE PERIOD

Stage	No. days	% of cycle	Must be housed in:
Mating to 4 weeks	28	18.1	Stalls or groups
Mid-pregnancy	82	52.9	Groups
Farrowing house from day 110 of pregnancy	5	3.2	Farrowing crate
Lactation	27	17.4	Farrowing crate
Weaning to mating	7	4.5	Stalls or groups
Other empty days	6	3.9	Stalls or groups
Total cycle	155	100	

5.2 GROUP TYPE

The main group housing systems in operation in Ireland and elsewhere can be categorised depending on whether the sows are kept in static or dynamic groups. The choice between the two will largely be based on the herd size. Smaller units usually adopt static groups and larger units dynamic groups. However with very large units, large static groups are also increasingly common.

I. STATIC GROUPS

In static groups, the group composition does not change once sows have been mixed. That is no new animals enter the group and none of the group members leave (unless they are injured or repeat) until the entire group is moved to the farrowing unit. This is beneficial in that the dominance hierarchy remains stable once it has been established and sows are only exposed to the stress of re-mixing once. In the past static groups were more commonly used with smaller herds and generally consisted of relatively small group sizes (between 4 and 12 sows). Hence, even at the space allowance required by legislation (2.25m^2/sow in groups between 5 and 40 sows) the amount of shared space in such static groups is minimal meaning that levels of social stress can be high. However, much larger static groups are an increasingly common feature of larger herds meaning that the amount of shared space is also higher. This gives sows more opportunities to escape from dominant individuals etc. One of the major disadvantages with static groups is that sows that are lost (i.e. die or are culled) from the system cannot be replaced meaning that a sow space lies empty. Management of repeats can also be difficult. Repeats generally remain in the group and have to be either moved into stalls (which will technically be illegal) or allowed to remain on their own in the otherwise empty pen when their penmates are moved to the farrowing house. The latter option means that the pen is 'tied up' longer than it should be which can put pressure on the rest of the system.

II. DYNAMIC GROUPS

In dynamic groups the group composition changes weekly with served sows entering the group and sows due to farrow exiting. Sows in large dynamic groups are therefore continuously exposed to the stresses of re-mixing. However, as dynamic groups are almost always associated with large group sizes, the benefits associated with large amounts of shared space generally outweigh the problem of continual re-mixing. In such systems, even at 2.025m^2/sow (for sows in groups $\geq$40) there is ample space for subordinate and otherwise vulnerable sows to avoid the aggressive encounters arising at the introduction of new sows each week. Furthermore, the use of sub-groups (see Box 4) helps to alleviate the stress placed on animals newly introduced to the herd. As the composition of a dynamic group is in a continual state of change it is well suited to handling repeats etc.

5.3 FEEDING SYSTEMS

The design of group housing systems is generally focused around the choice of feeding system. There is no one ideal feeding system and the choice will to a large extent be based on individual preference and the importance which a producer puts on certain requirements. One of these requirements might be the need for sows to feed simultaneously. As sows like to synchronise their behaviour, feeding systems that allow them to eat at the same time will obviously provide better welfare. However, the proviso is that sows are also protected from aggression while feeding. If not, the welfare benefits associated with synchronised feeding can be outweighed by the stress and injuries arising from fighting between the sows for access to the food. Although the problem can be partially alleviated by feeding higher fibre diets and/or reducing the frequency of feeding.

I. FLOOR FEEDING

a) Dump feeding

Feed is automatically dispensed onto a solid area of floor with a radius of 1.5m. Each feeder feeds up to 8 sows. Competition for access to feed is usually intense in this system.

b) Spin feeding

The feed is spread over a larger area than with dump feeding, ranging from 6-24m. Theoretically this gives all sows in the group better access to feed. This system could be used for groups of up to 25 sows suiting herds of 350 to 600 sows, but like dump feeding will result in intense competition for access to feed and variable body condition within groups. More than half the floor is solid with such systems.

With both spin and dump feeding systems it is crucial to match sows for size when filling pens. Unless opting for very small groups this might not be possible on smaller units.

II. LONG TROUGH

a) Welfare/free access stalls/voluntary cubicles

Many of the early adapters to group housing installed free access or welfare stall systems whereby sows were fed from a long trough but separated from one another during feeding by full length stalls. Traditionally sows in this system were kept in small groups of 4 to 6 sows where the small amount of shared space was more than compensated for by the presence of full length stalls in which the sows could escape from aggression/hide etc. The feeding stalls were dual purpose in that they were also wide enough for sows to use them for lying.

In Ireland sows are commonly wet fed twice per day in such systems. Groups of 6 require 10% less space per sow than groups of four. It is not recommended to design a pen for 5 sows.

b) 'Finisher style' long troughs

Sows in groups of between 10 and 20 feed simultaneously from a stainless steel long trough without any partitions. This type of feeding arrangement certainly allows more 'free' space in the pen but for some sows access to the trough is difficult and there can be competition and therefore a lot of swapping places at feeding. This can result in sows having to run up and down along the length of the trough looking for a point to access the food. This is a risk factor for claw damage as fully slatted flooring is the norm with such systems. Most importantly sow body condition can be uneven in such systems. Ideally there should be 18 inches (450mm) feeding space per sow and the water to meal ration should be kept at 3.5:1 to avoid very wet, slippery floors.

III. TRICKLE FEEDING

At feeding a slow running auger trickles feed, usually at a rate of 100-120g/minute, from calibrated hoppers into all troughs simultaneously. The rate is set to accommodate the slower feeding sows. Because the feed is dropped at such a slow rate the sow is encouraged to remain at her place. This should remove the need for trough divisions but in practice at least shoulder length partitions 0.45m apart (one per sow) are required as the levels of swapping can be high. Certainly there is poorer feed allocation in such systems than in ones with full length free access stalls. This system also forces the sow to adopt an unnatural feeding pattern. In Denmark where this system was popular it was used with static groups of 6-12 sows.

IV. ELECTRONIC SOW FEEDERS

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, leanness and prolificacy continue to be even further improved. If such sows are to stay productive it is essential

that they maintain their body fat reserves. Some would argue that this can only be achieved by feeding them as individuals. Electronic sow feeding (ESF) stations are the only way that individual rationing of sows can be achieved with group housing. Obviously sows cannot feed simultaneously in ESF and the sight and sounds of a sow feeding in the station stimulates the motivation to feed in the animals waiting outside. This can contribute to frustration and aggression in the queuing sows. However, the benefits associated with protected feeding and the ability to tailor the diet to the individuals requirements outweighs the fact that sows cannot feed simultaneously. ESF systems are almost always operated with dynamic groups but as herd sizes continue to increase it is possible to use ESF with large static groups of pigs. There is no consensus as what is the ideal layout is for an ESF system with different feeding station manufacturers offering different layout plans. However, sows should ideally be able to see the feeding stations from the lying area; most of them don't like to hang around in queues and will only get up to feed once they judge the queue to be short enough! This contributes to less activity, more resting and therefore less aggression in the group. Other important considerations include:

- Feed stations should not be placed directly against walls
- The exit should be well away from the entrance
- There should be a 180^0 approach angle to the feeder
- Allowing access all around the feeder allows sows to avoid confrontations
- Entries to and exits from feeders should not involve sows having to go up or down steps and slopes

a. The feeding station

Sows fed by ESF are identified by an ear transponder. Sows enter the feed station through a rear gate and are fed a pre-set amount of feed, depending on her stage of pregnancy and body condition. Feed allocation is computer controlled and with individual feed scales being entered into the computer. The computer also allows for the identification of sows which have not eaten etc. Sows which are due to farrow or need to be vaccinated etc. can automatically be shed from the ESF into a holding pen. Checking to see if sows that have not fed still have an active transponder in place is an essential feature of the daily management of ESF systems.

Stations used to differ in having rear or front /side exits. However, the former meant that sows had to exit though a hungry and therefore aggressive group of queuing sows. Vulva biting was very common in such systems and they have been largely replaced by front/side exit feeders. It is important that sows get some warning that the rear gate of the feeding station is going to be unlocked thereby giving her a chance to vacate the feeding station before another sow enters.

Feed troughs should not be available to sows that have consumed their daily feed allowance. The better designs swing the trough to one side to make it unavailable. This reduces the frequency of non-feeding visits to the feeder and allows more sows to be fed by one station. They also increase the life of the ESF as sows cannot bang the trough to try and dislodge feed. In systems where the trough is constantly available and certain sows manage to dislodge feed they will re-visit the ESF over and over again for the food 'reward'. The disruption they cause can disturb the entire group.

BOX 6

Feeding sows in an ESF

- Ideally there should be around 50 sows per feeding station (absolute max. of 80).
- Sows should be permitted to take their daily ration in one feed but not forced to do so.
- No water should be provided in the ESF as sows will be more encouraged to leave the station for a drink after eating.
- However, small amounts of water (40-50 ml per 100 grams of feed) can be provided with the food during feeding.
- Pelleted feed is preferable to meal as it reduces bridging.
- Dosing-speeds:
  - *Parity 1: 2 grams per second*
  - *Parity 2: 2.5 grams per second*
  - *Parity >3: 3 grams per second*
- Feeding: 1 x per 24 hours.
- All sows in the group should be able to get 4-6hrs per night of complete rest i.e. no sow should be able to feed during this time.
- Feed should be dispensed in small portions of 50-100g.

b. The shedding gate

This would appear to be a highly desirable management tool whereby sows are diverted into a selection pen. However, this is not always the case as sows will often resist exiting through an unfamiliar gate and can therefore 'clog' up the feeding station. Furthermore as sows may be held in the pen for long periods, selection pens must be warm and have a source of water placing additional constraints on design of the house.

c. Group size

An upper group size of 120 was proposed in the UK. Dynamic groups of less than 40 to 50 sows seem to be more unstable with introduction of new sows being easier in larger groups. While groups of over 250 with 4 feeders are being used it is very difficult to inspect and select sows in such large groups.

d. Bedding

In the UK straw bedded ESF systems predominate but in most Dutch units partly slatted floors are used with feeder located on the slatted portion. Straw usage in the UK has been estimated at 500kg per sow p.a. where scrapers are used and up to 1500kg per sow p.a. in deep bedded systems. Use of bedding implies provision of storage for the straw from one harvest to the next and storage of the solid waste generated.

5.4 PEN LAYOUT

As seen in section 3.1 free-living pigs maintain functionally distinct zones for sleeping (nest), dunging and feeding and these areas never overlap. If provided with distinct areas for resting and dunging sows will generally use them appropriately and there are welfare benefits associated with this natural behaviour. For example, designated lying areas encourage uninterrupted, calmer resting by sows where they are less likely to be stood on or attacked during competition for access to resources (i.e. feeders, drinkers or environmental enrichment). In the absence of distinct dunging and lying areas sows tend to excrete randomly in the pen and entire areas become wet, dirty and slippery. This not only poses a high risk of claw damage and lameness but results in dirty

and therefore unhygienic sows.

Where some effort is made to provide different zones for the sows there are three reasons why sows use them inappropriately:

a) thermal comfort issues
b) overstocking
c) lack of distinguishing features between the different zones

In relation to (c) it is rarely enough to simply provide a slatted area for dunging and a solid floored area for lying and to expect the sows to use them appropriately as these two areas are not truly functionally distinct. For example, the lying area, in addition to having a solid floor, should also be warmer (e.g. insulated concrete and draught free) than the dunging area and considerably more comfortable (e.g. bedded with straw or mats) to encourage sows to use them only for lying.

I. LYING AREA

S.I. 311 of 2010 states that a minimum floor area of at least 1.3 square metres for each pregnant sow, or 0.95 square metres for each gilt after service, should be made up of a continuous solid floor and no more than 15% of the floor area should consist of openings designed for drainage. Although the wording is somewhat ambiguous the intention is that sows should be provided with a lying area that is functionally distinct from the rest of the pen albeit in that the floor is solid or at least 'more solid' than the flooring in the rest of the pen.

It could be argued that slats 80mm wide with a 20mm slot satisfy this requirement when the cross ribs in the panel are taken into account, since a panel 1.2m x 0.6m (4ft x 2ft) of this type will have 14% open area. This interpretation thereby deems the entire floor area suitable for lying. However, the intention of the legislation was to have a functionally distinct zone for lying as this would protect the welfare of sows in groups. One of the major practical implications of this pen design is that the entire area of the pen is also deemed suitable for dunging by the sows. This contributes to problems with dirtiness and lameness.

Another thing to consider in the design of areas for sows to lie in groups systems is the availability of structures for sows to lie against. Sows like to steady themselves against a wall/partition while lying down which is why pen perimeters are usually in such demand as lying areas. In very large unbedded groups vast uninterrupted open areas are not of much use to sows for lying as they have nothing to lie down against. It is better to create several individual solid floored lying 'bays' where up to 5 or 6 sows can lie together. Incidentally such lying bays also encourage sows in large groups to form sub-groups where social and other stressors are counteracted by the social support the sows get from preferred pen mates. Certainly in large dynamic groups of sows the lying area should be subdivided into bays approximately 6m x 6m.

II. TROUGH ARRANGEMENT

Where sows are fed from long troughs along two sides of the pen whether with full length free access stalls, shoulder length or no trough divisions there is more swapping, frustration and aggression at feeding. From the authors experience vulva biting is also a problem with such systems (10% of sows affected) which should be avoided unless self closing full length stalls can be used.

Another problem with systems that have troughs on two sides of the pen or indeed two rows of free access stalls is that the sows tend to dirty in between the two troughs/rows. This is compared to where there is a single trough/row of free access stalls where the sows will dirty at the furthest point from the trough i.e. the opposing wall. This creates a dangerous environment for movement and fighting etc. as the floor (even if slatted) is wetter and more slippery. Unsurprisingly sows

usage of the communal/loose area is very low where there are two rows of free access stalls and they benefit little from the advantages associated with group housing i.e. improved fitness and stronger legs.

III. FREE ACCESS 'WELFARE' STALLS

The length of the stall has a major impact on feed rationing. The longer the length of the stall/trough division the higher the proportion of sows that are able to consume the correct amount of food (Table 5). Of course the eating speed of sows on a wet diet is much less variable than for sows on a dry diet so the length of the stall is slightly less crucial for wet fed animals.

TABLE 5. FEEDING BEHAVIOUR OF SOWS FED IN FREE ACCESS STALLS (HILLSBOROUGH DATA)

	Free access stall /trough division length		
	2.0m	1.0m	0.5m
% of sows eating exact ration	77	60	40
No. of withdrawals per sow during feeding	0.76	1.01	3.43

Free access stalls also act as places for sows to protect themselves from aggression. Obviously the longer the stall the more protection it offers. With free access stalls it can appear that sows use them for lying most of the time. This is certainly the case with two rows of stalls with a central slatted passage. In such systems sows are reluctant to use the central area for lying as it is an area of high traffic and too much disruption. However the factors influencing a sows choice of a place to lie are complex. In Hillsborough sows were given the free choice of ungated free access stalls, self closing/sow operated stalls (all stalls were solid floored) or an insulated solid floored communal area for lying. Sows spent 13% of their time lying in the each of the stall types and 74% of their time lying as a group. This indicates that sows have a preference for communal lying. However, research from Moorepark showed that if the flooring in the communal area is fully slatted and only the stalls have solid flooring sows will spend more time lying in the stalls compared to when both areas are slatted. This research shows that while sows like to lie together they will forfeit lying together to lie in stalls on solid flooring.

5.5 FLOORING

An ideal floor should maximise animal comfort, minimise injury or disease and should not become deformed, deteriorate or require extraordinary maintenance. When it comes to leg problems and sow longevity, floor quality is more important than any other design feature of group housing systems. As already shown lameness is a bigger welfare problem for group housed sows kept on partially or fully slatted concrete flooring without any bedding than it is for sows in crates on the same flooring. Levels of claw and joint lesions are similar in both systems but the activity and aggression inherent to group systems means that damage to the feet caused by the floor is more likely to lead to lameness. For this reason the flooring used in group housing systems requires particular attention.

I. STRAW

Bare (solid or slatted) concrete flooring is abrasive, injurious and cold and has no cushioning or shock absorbing properties (i.e. is uncomfortable). Furthermore, culling for lameness is higher in group systems where little or no bedding used. For this reason group housed sows should ideally be on deep bedding. There are several reasons why this will not be feasible on many units but in situations where it might be an option the use of bedding should be given serious consideration. In the scientific literature fully slatted floors are consistently associated with higher rates of culling for lameness in group systems.

If there is a desire to keep culling and deaths due to lameness to a minimum then the best compromise is to provide sows with some areas of solid flooring (for lying and preferably covered with at least some bedding and/or mats) and to make the slatted areas as safe and comfortable as possible for walking.

II. RUBBER MATS

Rubber flooring is likely to play a major role in reducing lameness in pigs and particularly sows in the future. Sows certainly show a preference for resting on rubber compared to bare concrete. Furthermore, recent research by Ms. Julia Calderon Diaz conducted on a large commercial farm found a beneficial impact of housing pregnant gilts on rubber flooring on walking/locomotory ability and on the development of some claw and limb lesions (notably swellings and wounds). In that study 160 gilts were kept in groups of 8 in fully slatted pens with free access feeding stalls. In the rubber treatment (80 gilts) the slats were covered with rubber slat mats especially designed for use with pigs. The improvements in walking ability contributed to fewer piglets crushed in the farrowing crate during the gilts first lactation. Importantly there was also less culling for lameness in the first parity gilts that were kept on rubber.

III. SLATTED FLOORS

Anecdotal and experimental evidence shows that slats wider than required by legislation provide the best foothold, are the most comfortable and the least injurious for sows. From our experience 80mm is the absolute minimum and slats for use in group systems should ideally be a minimum of 120mm.

5.6 HIGH FIBRE DIETS AND ENVIRONMENTAL ENRICHMENT

Manipulable substrates are not only required by legislation but they may also be able to reduce levels of aggression in sows as they give the sows something to do. Ideally manuipulable substrates should be in the form of straw or silage provided in racks, lengths of natural fibre rope or nibbling beams (Figure 14). Substrates such as chains or plastic 'toys' do little to stimulate sows interest or to distract them from fighting. Ways of incorporating manipulable substrates into the design of any group housing system must be a major consideration at the planning stage.

FIGURE 14. NIBBLING BEAMS

Under Council Directive 2001/88/EC sows must be provided with a high fibre diet to satisfy their hunger and need to chew. How did this legislation arise? Foraging behaviour forms a large part of the pigs behavioural repertoire. Pregnant sows are restricted to 50 to 60% of their voluntary feed intake meaning that they are hungry. Furthermore as many are only fed a small volume of a rapidly consumed diet once or at most twice per day they are prevented from performing foraging behaviour. This results in a high and unrewarded motivation to forage and feed resulting in frustration, aggression, restlessness, non-essential drinking (i.e. 'playing' with water) and stereotypies such as sham chewing. This behaviour is a meaningless, repetitive behaviour performed by the sow whereby she appears to be chewing something in her mouth. Copious amounts of saliva are often produced (Figure 15).

FIGURE 15. HIGH FIBRE DIETS REDUCE SHAM CHEWING BEHAVIOUR WHICH IS AN INDICATOR OF POOR WELFARE OF SOWS

High fibre diets promote feelings of satiety (i.e. sow feels 'full up') as they offer better 'gut fill', a slow steady release of nutrients which prolongs the supply of energy and alter glucose metabolism such that sows feel sated for longer. For these reasons the sows motivation to feed and forage is reduced. This in turn reduces levels of frustration, restlessness and aggression, the result being an increase in resting behaviour. Some of the potential problems with feeding high fibre diets include unwanted weight gain and increased backfat levels, the potential that the digestibility of energy and nutrients will be reduced and the requirement for extra feed and manure storage facilities. The optimum level of fibre to feed is likely to vary with feeding frequency, regime and source. Nevertheless benefits have been seen with levels between 8% and 23% crude fibre. Considering that the standard crude fibre level of most dry sow diets is 4-5% this represents a considerable increase.

I. INGREDIENTS

The following are potential ingredients to include in dry sow rations to increase the fibre content:

- Sugar beet pulp
- Wheat bran
- Corn / cobs
- Oats / oat hulls
- Soya hulls
- Chicory

II. FORAGING SUBSTRATES

Another option is to provide sows with foraging substrates in the form of straw or silage. This option not only fulfils the requirement to provide a high fibre diet but also meets the legislative requirements to provide sows with manipulable substrates. In systems with areas of solid flooring it is easy to provide straw for foraging at floor level. Otherwise such substrates can be provided in racks.

III. FEEDING REGIME

Generally once a day feeding is better than twice a day feeding as sows can ingest a larger meal and experience better 'gut fill'. Because of the large volume involved wet feeding is better than dry feeding from the point of view of 'gut fill'. However, the volumes involved can also make it difficult to provide the daily allowance in one feed. On farms where sows are wet fed from a long trough, spacing both feeds close together has reduced the amount of aggression and disruption that occurs at feeding.

5.7 WATER

Water must be continuously available to all sows in a group irrespective of whether or not they are fed a wet diet so facilities for water provision must be included in any design specification.

Interestingly sows in stalls provided with water 2 times/day for 45 minutes drink about 12 litres water per day. In comparison group housed sows with continuous access to water drink about 9 litres water per day. It is likely that individually housed sows drink more water out of boredom.

In large groups one drinking-point should be provided per 20-25 sows. Drinkers should be easy to reach. Sows prefer to 'slurp' water rather than to drink it via a nipple, therefore a bowl-shaped drinking-unit such as the one in the photo below is ideal.

FIGURE 16. BOWL SHAPED DRINKER

5.8 CLIMATE CONTROL IN GROUP HOUSING SYSTEMS

Sows in groups will have more wall, roof and floor area (per animal) through which heat may be lost. In the absence of ample bedding, it will be more difficult to maintain house temperatures above the requirement of the animals. This is approximately 20ºC in dry, draught free conditions or higher on wet feed systems especially if the water to feed ratio is high (above 3:1) or liquid by-products are fed.

Cold stress will result in a higher feed requirement to supply energy for the increased maintenance. In the absence of additional feed, a cold environment will result in a smaller gain of body weight during gestation or, in extreme conditions, to a loss of body reserves.

Ventilation rate should be well controlled. High minimum speeds settings on fans are the main cause of over ventilation. Elimination of air leakage is critical. Leakage occurs through:

- Cracks
- Poorly fitted doors, windows or shutters
- Fan chimneys
- Damaged insulation
- Poorly installed or maintained insulation
- Under slats

CHAPTER 6

OPTIONS FOR GROUP HOUSING IN IRELAND

6. Options for group housing in Ireland

DISCLAIMER

The drawings in this section are for guideline and discussion purposes only.

Please discuss these drawings with your architect/engineer before using them as suitable drawings for your site.

The individual drawings done for any specific site should ensure that the drawing of pen sizes and divisions (which will vary in thickness depending on the product used) and all dimensions reflect the building materials and pen sizes planned on that site.

In practice, some units have allowed pen divisions rest on supporting walls or beams for slats – in such situations the beams and all dimensions will have to be increased accordingly. There may be other features that need to be adjusted specific to the herd size, building materials to be used, along with other factors and these may affect the overall internal and external dimensions.

6.1 ELECTRONIC SOW FEEDING (ESF) SYSTEM

FIGURE 17. ESF SYSTEM: SOWS LYING IN SOLID FLOORED LYING BAYS

Advantages from the point of view of sow behaviour and welfare

- Only system in which sows can be housed as a group but fed as individuals thereby guaranteeing adequate feed intake
- Sows are protected at feeding
- Sows can adopt an individual and flexible feeding pattern (within the constraints imposed on feeder use by the other sows in the group)
- Even though space allowance per sow is low in groups >40 sows (2.025m^2/sow) sows have a large area of shared space
- There are functionally distinct places to feed, lie, drink and defecate/urinate
- Areas of solid flooring can be included (e.g. in the lying areas)
- Large amount of space to provide foraging materials and other manipulable materials
- Sows can exercise a high degree of control over their thermal environment i.e. there is enough space and variation in the house for sows to find warm areas if cold and cooler areas if they are too hot
- Enables sows to enjoy a very rich and varied repertoire of behaviour particularly when bedding/foraging material is provided
- Sows have free access to a boar

Disadvantages from the point of view of sow behaviour and welfare

- Very large social groups may make it difficult for sows to remember where other sows are in the dominance hierarchy but this problem can be overcome if subgroups are formed prior to introducing new sows to the main group
- Unstable dominance hierarchy – group composition constantly changing as sows enter and leave the group so there can be problems with chronic aggression especially if sub groups not formed
- This in turn can lead to high levels of aggression directed particularly towards young/ subordinate sows entering the group leading to stress, reproductive failure, lameness etc.
- Sows cannot feed at the same time (but they overcome this by developing their own individual and flexible feeding pattern)
- Some animals fail to learn how to use the feeder and may suffer poor welfare as a result
- If transponders get lost affected sows miss out on feed events

Advantages from the point of view of the producer/stockperson

- If well designed, managed appropriately and under high standards of stockmanship this system potentially offers sows the highest standards of welfare of all group housing systems – this is rewarded by high levels of sow productivity and good sow longevity
- ESF systems facilitate a very high degree of feed management (only system in which sows can be fed as individuals)
- Allows for treatments to be targeted towards individuals e.g. dosing/parasite control
- In well managed units sows become very docile and easy to handle in these systems such that finding one and removing her is easy
- Sows have free access to a boar

Disadvantages from the point of view of the producer/stockperson

- If poorly designed, managed inappropriately and under low standards of stockmanship this system could result in the poorest standards of welfare of all group housing systems – this would result in low levels of sow productivity and poor sow longevity
- High reliance on computerised equipment - What to do in case of a breakdown?
- Requires very good stockpersons and a highly animal orientated style of management
- Solid floored lying bays may on rare occasions need to be cleaned
- Absolute necessity to train gilts to the system (time and patience required)
- Works best when combined with straw bedding
- Transponder loss can be a problem
- Difficult to find repeats (especially in very large groups)
- High level of mechanisation as well as computer work involved

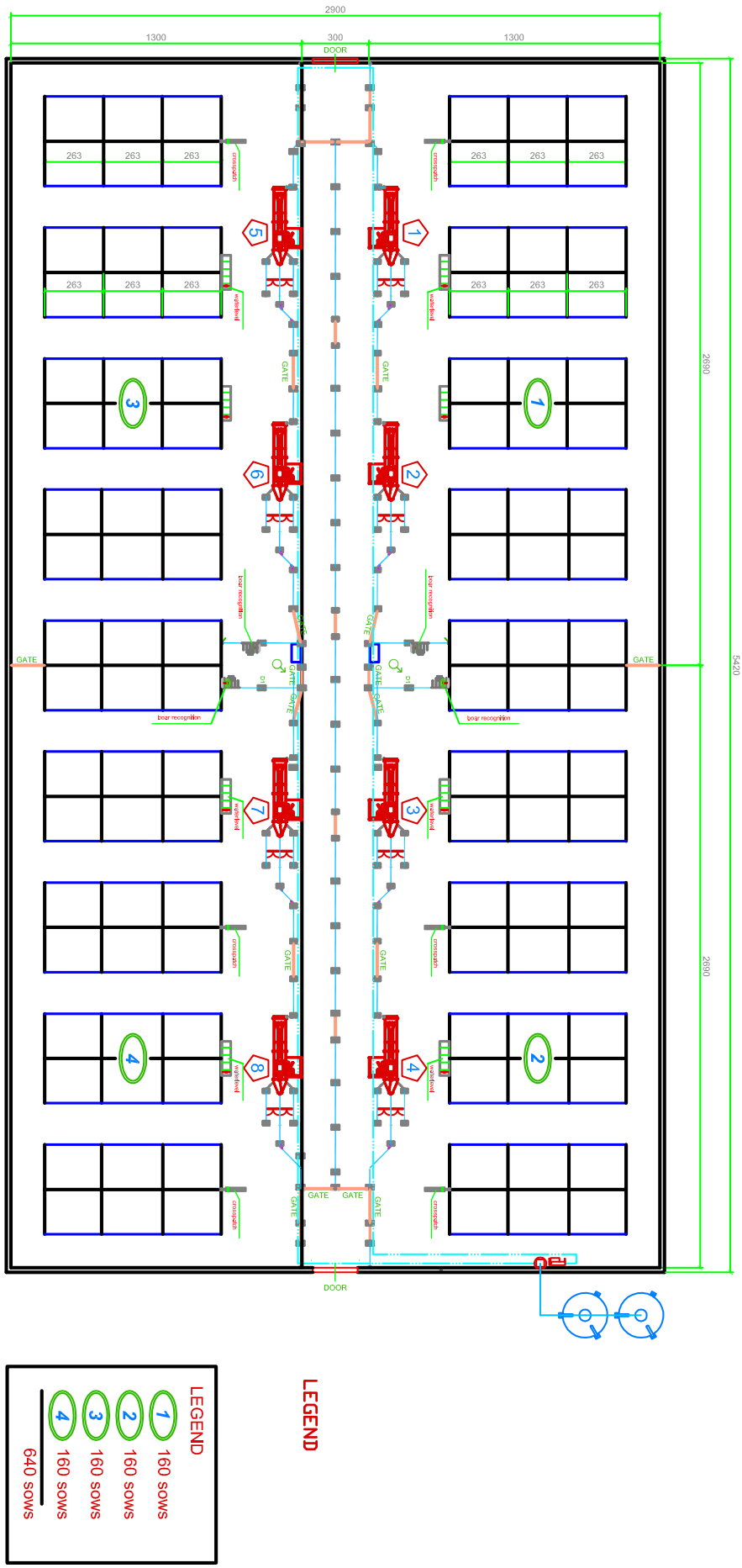

FIGURE 18. ESF SYSTEM

6.2 FREE ACCESS STALLS

FIGURE 19. SOWS IN GROUPS OF FOUR IN A FREE ACCESS STALL SYSTEM

Advantages from the point of view of sow behaviour and welfare

- Stable groups
- Sows can feed simultaneously
- Sows are protected at feeding
- Subordinate (low ranking) or injured animals can protect themselves in the stalls both at mixing and thereafter
- Sows have some degree of choice as to where to lie: they can lie singly and protected in the stalls or communally in the slatted loose area
- There are functionally distinct locations in the pen – specific place to eat and lie and because of this sows generally excrete at the back wall (i.e. the furthest point from the free access stalls)
- Allows for areas of solid flooring to be included (i.e. in the free access stalls)
- Individual racks for foraging or other manipulable materials could be provided in the stalls
- Sows can exercise some degree of control over their thermal environment i.e. lie in the solid floored stalls if cold or spread out on the slats if too warm
- Stalls offer many surfaces to sows for supported lying

Disadvantages from the point of view of sow behaviour and welfare

- Low area of shared, 'free' space leading to intense aggression at mixing
- Fully slatted flooring in loose area where all the fighting is done could lead to claw injuries
- Sows can't be fed according to their body condition

Advantages from the point of view of the producer

- Easy to manage
- No need to train gilts
- Smaller group size

Disadvantages from the point of view of the producer

- Large amount of steel which is relatively costly
- Lot of maintenance (i.e. welding) as steel depreciates
- Can't vary feed allocations according to sow body condition
- Difficulties dealing with repeat sows

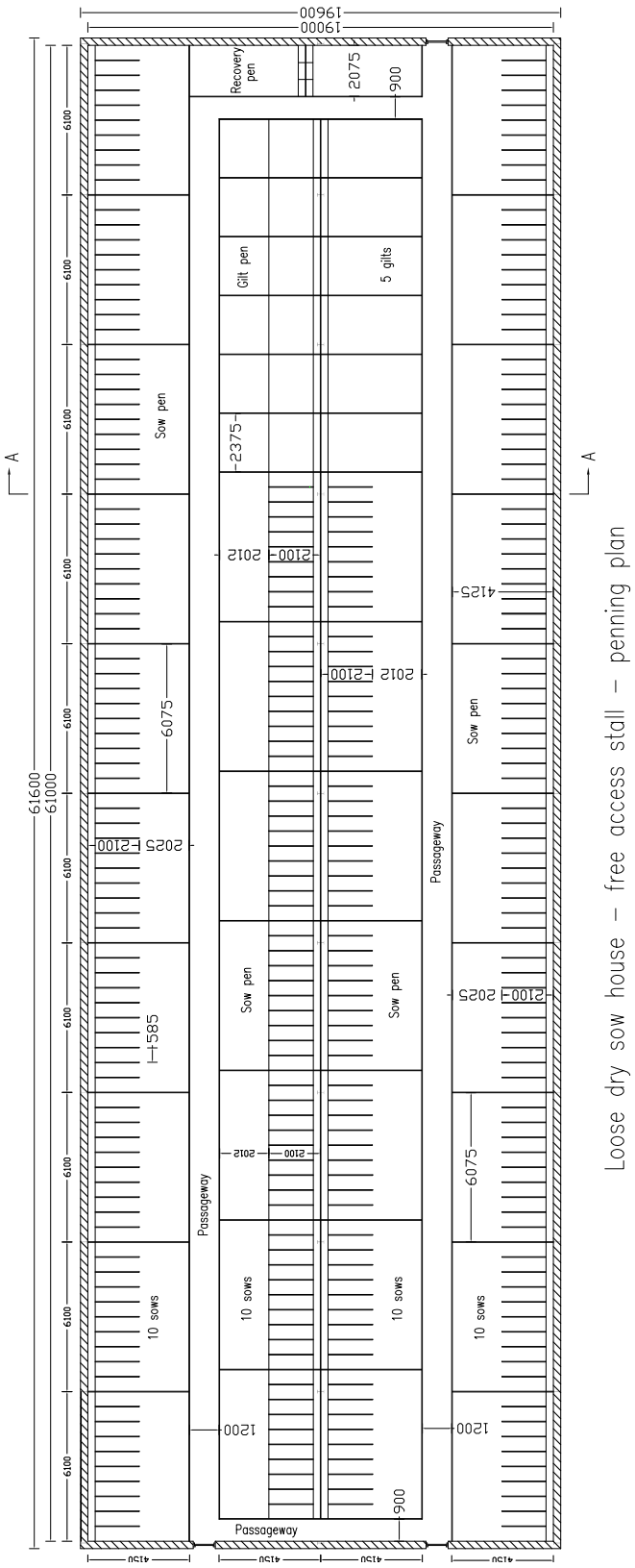

FIGURE 20. FREE ACCESS STALLS

6.3 FLOOR FEEDING SYSTEM

FIGURE 21. SOWS IN A FLOOR FEEDING SYSTEM

Advantages from the point of view of sow behaviour and welfare

- Stable group
- Sows can feed simultaneously
- There is a functionally distinct (i.e. slatted) dunging area and lying/feeding area (solid floor)
- A large area of solid flooring is necessary for floor feeding making it possible to provide foraging material on the floor
- Sows are fed a dry feed which may lend itself better to a higher fibre content

Disadvantages from the point of view of sow behaviour and welfare

- Low area of shared space leading to intense aggression at mixing
- Intense competition at feeding which continues long after the dominance hierarchy has been established
- The area where sows are supposed to rest is also the focus of intense aggression and activity at each feeding
- No protection/places to hide for subordinate animals = chronic stress
- Sows can't be fed according to their body condition

Advantages from the point of view of the producer

- Low maintenance
- Easy to manage
- No need to train gilts
- Smaller group size

Disadvantages from the point of view of the producer

- Potentially high levels of sow wastage arising from stress induced reproductive failure
- Can't vary feed allocations according to sow body condition
- Difficulties dealing with repeat sows
- May need to clean solid areas
- More feed wastage
- Hygiene management more difficult because sows must eat off the ground

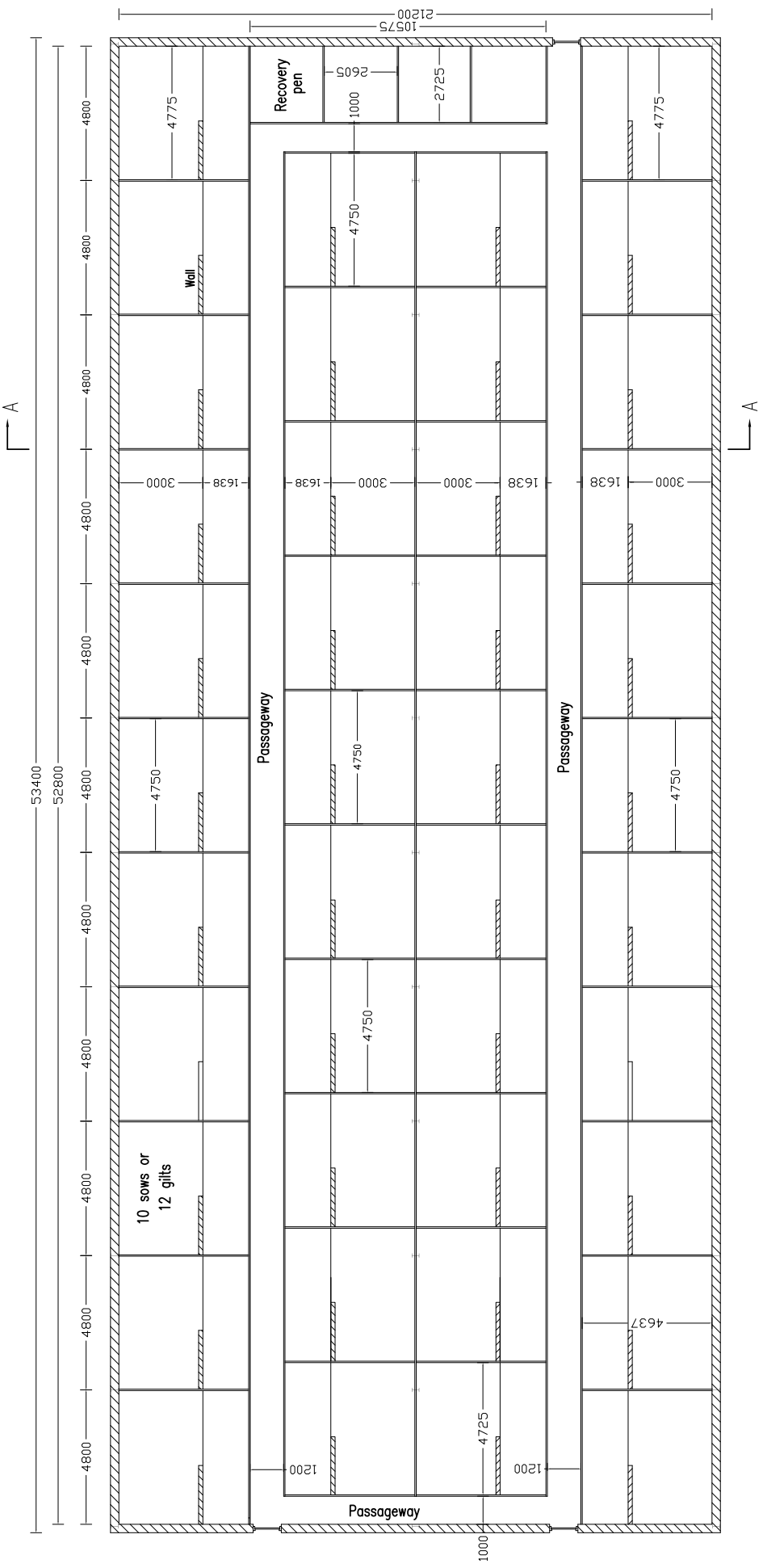

FIGURE 22. FLOOR FEEDING SYSTEM

6.4 LONG TROUGH

FIGURE 23. SOWS IN A LONG TROUGH SYSTEM

Advantages from the point of view of sow behaviour and welfare

- Sows can feed simultaneously
- Easy to check that sows are eating
- Stable group (no new sows entering once group is formed)

Disadvantages from the point of view of sow behaviour and welfare

- Minimal space allowance combined with small area of shared space means there is intense aggression at mixing
- Fully slatted flooring and difficult to incorporate areas of solid
- Competitive feeding/no protection for sows at feeding causing aggression and stress at feeding in some cases
- No functionally distinct locations in the pen
    - *No clearly defined lying area (difficult for sows to rest undisturbed)*
    - *No pre-determined dunging zone (sows excrete randomly in the pen)*
- Inadequate surfaces for sows to lie down against – sows forced to lie down unsupported
- No protection/places to hide for subordinate sows/gilts = chronic stress
- Sows can't be fed as individuals (i.e. more if thin and less if fat)

Advantages from the point of view of the producer/stockperson

- Stable group can be advantageous from a management point of view
- Easy to manage
- No need to train gilts
- Smaller group size
- Easy to check sows are eating

Disadvantages from the point of view of the producer/stockperson

- Potentially high levels of sow wastage arising from lameness and reproductive failure
- Difficulties dealing with repeat sows
- Can't vary feed allocations according to sow body condition

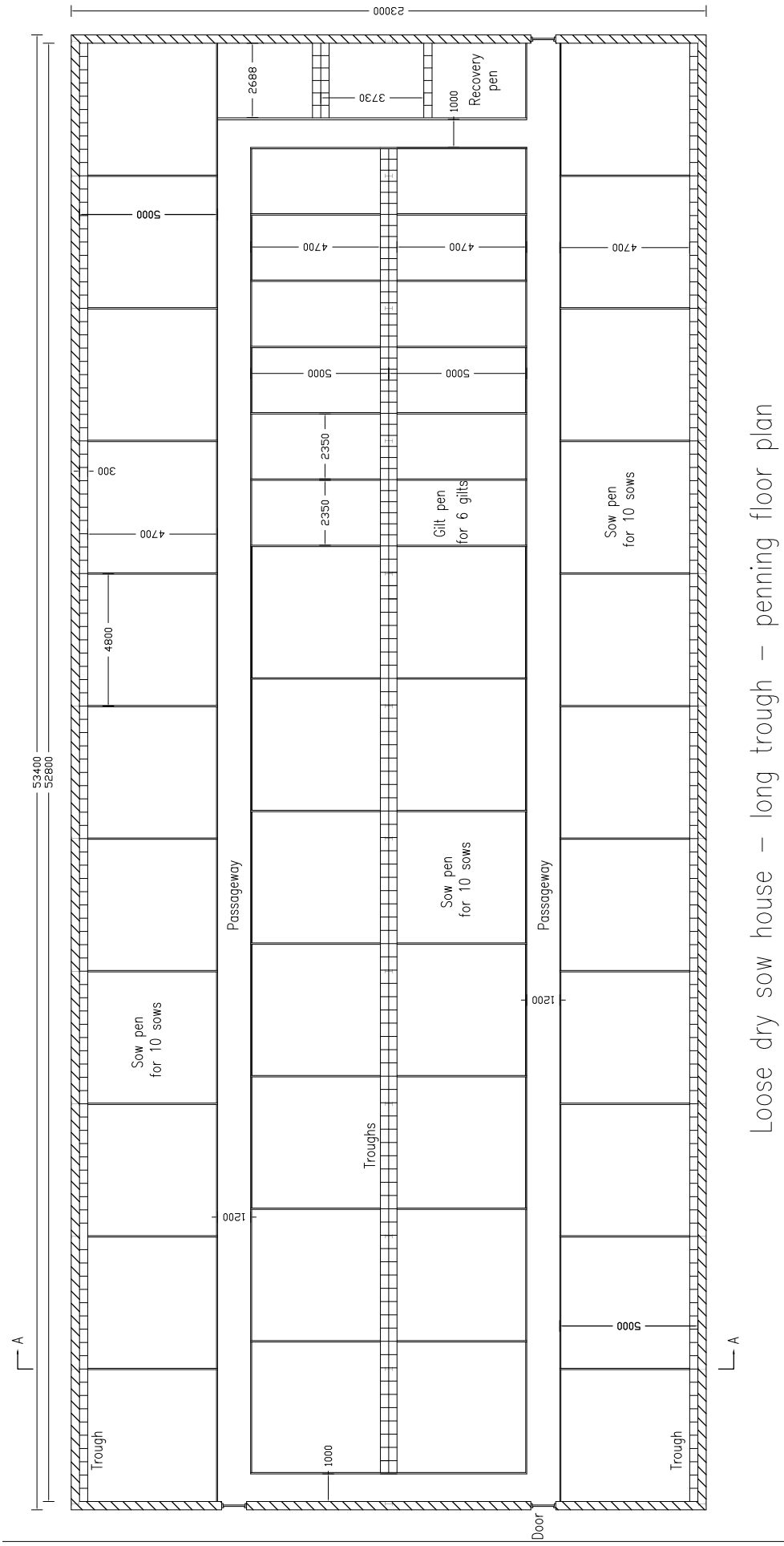

FIGURE 24. LONG TROUGH SYSTEM

6.5 COST OF EACH GROUP HOUSING SYSTEM

TABLE 6. APPROXIMATE COST PER SOW SPACE OF EACH OF THE FOUR GROUP HOUSING SYSTEMS*

**excluding cost of tank and VAT*

Group housing system	Cost* per sow space (€)
Electronic sow feeding	432
Free access stalls	800
Floor feeding	400
Long trough	638

6.6 USEFUL DOCUMENTS

These can all be found at **www.teagasc.ie/pigs**

- S144 August 2010 - Minimum Specification for Loose Dry Sow Units
- S144a August 2010 - Accepted Pre-Fabricated Wall Panels for Pig Houses
- Changes to S. 101 & S. 123 (March 2006)
- SI 123 - Minimum Specification for Bovine Livestock Units and Reinforced Tanks
- SI 101 - Minimum Specifications for the Structure of Agricultural Buildings
- SI 100 July 2004 - Minimum Specification for Concrete Grades Used in Agricultural Structures
- Targeted Agricultural Modernisation Scheme (TAMS) Sow Housing Welfare Scheme - In Implementation of Council Regulation (EC) No. 1698/2005 and Commission Regulation 65/2011

CHAPTER 7

RESEARCH FROM MOOREPARK ON GROUP HOUSING

7. Moorepark research on group housing

7.1 STATUS OF EXISTING IRISH GROUP SYSTEMS

Since 2011, almost 50 pig units in Ireland have been surveyed as part of a collaborative project between Teagasc and Warwick University in the UK. Sows were housed in groups on 21 of these units. Data on the 131 gilts and 174 sows inspected on the farms were collated for this report. Two-hundred and thirty animals were housed in groups with either free access stalls or open troughs indicating that these systems are by far the most common. Six of the farms operated 2 systems: free access stalls for the sows and long troughs for the gilts.

I. FLOORING

On 9 farms the flooring was fully slatted while on 12 farms the flooring could be classified as partially slatted (i.e. there were some areas of solid concrete). Most of the units with designated areas of solid flooring had either ESF or floor/drop systems. In the ESF systems solid areas of concrete were in the form of lying 'bays'. In drop-fed systems areas of solid concrete are a necessary feature as sows feed off the floor. All of the pens in which there were randomly distributed areas of solid flooring were in converted houses.

On the majority of farms both sows and gilts were on slats that were in accordance with what is laid down in SI 311 (Table 7).

TABLE 7. NO. OF FARMS THAT KEPT GILTS AND SOWS ON SLATS THAT WERE NARROWER THAN 80MM, EXACTLY 80MM OR WIDER THAN 80MM

	No. Farms	
	Gilts	Sows
Narrower than 80mm	2	3
80mm	6	9
Wider than 80mm	11	11

In the majority of farms the slot widths were in accordance with what will be required under SI 311 but on 7 farms sows were kept on slats with void widths larger than what will be allowed (Table 8).

TABLE 8. NO. OF FARMS THAT KEPT SOWS AND GILTS ON SLATS THAT HAD VOIDS/GAPS WIDER THAN 20MM, 20MM OR NARROWER THAN 20MM

	No. Farms	
	Gilts	Sows
Narrower than 20mm	0	0
20mm	17	15
Wider than 20mm	2	7

II. STOCKING DENSITY

Replacement gilts were overstocked on 13 of the 19 farms on which measurements on gilts were taken (Table 9). Overstocking of gilts is clearly a problem on farms and this has serious implications for social stress, lameness and ultimately sow productive lifetime..

TABLE 9. NO. OF FARMS ON WHICH SOWS AND GILTS WERE UNDER / OVER STOCKED OR STOCKED APPROPRIATELY

	No. Farms	
	Gilts	Sows
Under stocked	3	10
Stocked appropriately	3	5
Overstocked	13	6

III. GROUP SIZE

On the majority of farms both sows and gilts were kept in groups of between 6 and 39 animals. Much larger group sizes were synonymous with ESF systems (Table 10).

TABLE 10. NO. OF PENS ON EACH OF 21 FARMS WITH SOWS AND GILTS IN DIFFERENT GROUP SIZE CATEGORIES

No. Animals / Group	No. Farms	
	Gilts	Sows
0 - 5	7	8
6 -39	10	10
>39	2	3

IV. LAMENESS

Lameness scores (see Figure 4) increase according to severity so 'sound' animals receive scores of 0 or 1 if some slight abnormality in their ability to walk is evident. Almost 50% of the 305 animals inspected on 21 different sites were lame i.e. they received scores of 2 or ≥3 for their walking ability (Table 11).

TABLE 11. PROPORTION OF INSPECTED ANIMALS (%) ON 21 FARMS THAT RECEIVED EACH LAMENESS SCORE

Lameness score	No. Animals	%
0	13	4.3
1	145	47.5
2	124	40.7
≥3	23	7.5

These figures show similar proportions of lame and non-lame sows and gilts irrespective of housing system (Table 12). The common denominator between all of these systems is the use of concrete flooring.

TABLE 12. NO. OF ANIMALS IN EACH HOUSING SYSTEM THAT WERE EITHER LAME (>1) OR NON-LAME (SCORES 0 AND 1)

Lameness score	Non-lame *(scores 0 and 1)*	Lame *(scores >1)*
Drop-fed	0	6
ESF	36	24
Free access stall	63	54
Open feeder	5	4
Open trough	67	46

The data in Table 13 clearly show more lameness when slats are too narrow (73.3%) and less lameness (38.2%) when slats are wider than required by SI 311 of 2010 (i.e. >80mm).

TABLE 13. PROPORTION OF LAME AND NON-LAME SOWS AND GILTS IN PENS WHERE SLATS WERE NARROWER THAN 80MM, WIDER THAN 80MM OR 80MM

Score	Non-lame *(scores 0 and 1)*	Lame *(>1)*
Narrower than 80mm	8 (26.7%)	22 (73.3%)
80mm	56 (45.5%)	67 (54.5%)
Wider than 80mm	94 (61.8%)	58 (38.2%)

Approximately equal proportions of gilts were lame and non-lame (Table 14). A slightly higher proportion of sows were non-lame which reflects the fact that sows go through a process of rigorous involuntary removal for lameness in the first and second parity. Those that survive this process are less likely to go lame thereafter.

TABLE 14. PROPORTION OF SOWS AND GILTS IN THE TWO CATEGORIES LAME AND NON-LAME

Score	Non-lame	Lame
Gilts	63 (48.1%)	68 (51.9%)
Sows	95 (54.6%)	79 (45.4%)

V. CONCLUSIONS

These preliminary data indicate that irrespective of the system employed lameness is a problem in group housed sows on concrete. There were indications that slat widths wider than required by legislation might be beneficial in reducing lameness. Overstocking of gilts is a widespread problem and some producers will need to change their slats in order to be in compliance with SI 311.

7.2 COMPARISON OF PERFORMANCE OF LOOSE AND STALL HOUSED SOWS AT MOOREPARK

Reproductive performance data were collected during eight months on 159 sows in the Moorepark herd managed either in stalls (66 sows) or in a single large dynamic group (93 sows) and fed by an ESF during pregnancy. No significant differences were detected between loose or stall housed sows in any of the performance variables (Table 15).

TABLE 15. PERFORMANCE OF SOWS IN THE MOOREPARK HERD THAT WERE EITHER HOUSED IN STALLS OR LOOSE IN GROUPS DURING PREGNANCY

	Loose (n=93)	Stall (n=66)	
Live birth weight (kg)	1.43 (±0.02)	1.45 (±0.02)	Non-significant
Live born (no.)	13.71 (±0.30)	13.14 (±0.35)	Non-significant
Stillborn (no.)	0.98 (±0.13)	1.13(±0.15)	Non-significant
Mummified (no.)	0.44 (±0.08)	0.51 (±0.10)	Non-significant
Mortality rate (%)	13.4	11.3	Non-significant
Total no. died during lactation	1.82 (±0.17)	1.71 (±0.19)	Non-significant
No. crushed during lactation	1.72±0.15	1.48±0.17	Non-significant

Loose sows were numerically heavier prior to farrowing but this difference was not significant (Table 16).

There was no significant difference between housing systems in the number of sows that required assistance during farrowing (8.60% loose vs. 10.61% stall; P>0.05).

TABLE 16. BODY WEIGHT PRIOR TO FARROWING AND AT WEANING OF SOWS HOUSED EITHER IN STALLS OR LOOSE IN GROUPS DURING PREGNANCY

Sow weight (kg)	Loose (n=93)	Stall (n=66)	P
Pre-farrowing	264.49 (± 4.32)	259.73 (± 4.70)	Non-significant
Weaning	227.61 (± 3.83)	223.96 (± 4.17)	Non-significant

What is clear from these results is that the performance of sows housed in groups or in stalls is similar when managed and fed under the same system.

7.3. RESEARCH ON HIGH FIBRE DIETS AND FORAGING SUBSTRATES FOR GROUP HOUSED SOWS

Research was conducted using a large dynamic group system (Split-yard with ESF – Hillsborough) whereby straw was provided in racks (Study 1) or a high fibre (15% CF) diet based on sugar beet pulp and soya hulls was fed (Study 2) to pregnant sows. At Moorepark sows in groups of four with full length free access stalls (Welfare stalls) were either provided with straw in racks and fed a diet containing 9% CF (based on soya hulls), were just provided with straw in racks or were just fed the 9% CF diet and compared to a control (Study 3).

I. STUDY 1

Providing sows in a dynamic group and fed by an ESF with straw in racks (one 1.22m long and 0.8m deep rack per 40 sows) had no effect on sham chewing but the amount of straw provided only worked out at 0.2kg straw/sow/day. There was great interest among the sows to use the racks and this often sparked aggression. Indeed there was slightly more aggression in the groups that had a straw rack then in those that had none (i.e. the control groups). Therefore straw racks should be longer or else a higher ratio of racks to sows is required so that more sows can access racks simultaneously. It was difficult to provide enough straw to the sows to impact positively on welfare as the sows removed it from the racks very rapidly.

FIGURE 25. SOWS FORAGING STRAW PROVIDED IN A RACK

II. STUDY 2

The 15% crude fibre diet in this study dramatically increased resting behaviour of the sows (Figure 27). Furthermore, there were more newly introduced sows resting in the kennel areas compared to in the slatted areas in the high fibre treatment (Figure 28). This indicates that resident sows on the high fibre diet, being calmer, were more willing to allow newly introduced sows to use the kennels for lying. While in the control treatment, resident sows were less willing to allow newcomers to assimilate into the group and therefore the newly introduced (and therefore low ranking) animals had to lie in the slatted areas. The high fibre diet also reduced sham chewing behaviour by 75%.

FIGURE 26. SOWS RESTING CALMLY (I.E. WITH THEIR EYES CLOSED) IN KENNELS IN A DYNAMIC GROUP HOUSING SYSTEM

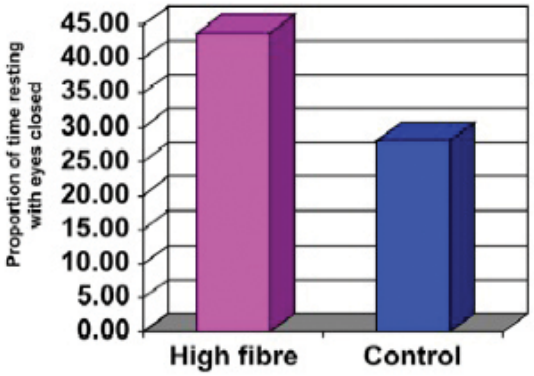

FIGURE 27. RESTING BEHAVIOUR BY SOWS IN A DYNAMIC GROUP AND FED A HIGH FIBRE OR CONTROL DIET BY ESF

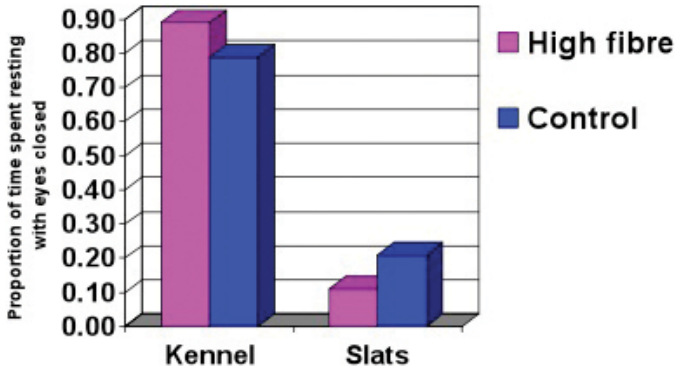

FIGURE 28. RESTING LOCATION OF SOWS NEWLY INTRODUCED TO A DYNAMIC GROUP AND FED A HIGH FIBRE OR CONTROL DIET BY ESF

III. STUDY 3

In the welfare stall system straw alone provided in racks reduced aggression but had no other effect. When it was combined with the 9% crude fibre diet sham chewing was reduced. The high fibre diet alone promoted resting behaviour.

FIGURE 29. SOWS IN WELFARE STALLS WITH INDIVIDUAL STRAW RACKS

IV. CONCLUSIONS

Sow behaviour and welfare benefits from even small increases in fibre levels and/or provision of foraging substrates. Calmer and better rested sows leads to a less stressful environment in which there is less aggression and therefore fewer injuries to the skin and feet. Ultimately this leads to benefits for sow longevity. In making decisions about group housing it is essential that consideration is given to the fact that fibre content of diets for gestating sows must be revised upwards to comply with legislation.

CHAPTER 8

APPENDICES

8. Appendices

8.1 GILT REARING AND MANAGEMENT IN RELATION TO GROUP HOUSING

I. INTRODUCTION

From research conducted in Ireland and abroad it is becoming increasingly clear that one of the critical factors determining the success of group housed sows from the point of view of performance and longevity is the way in which the replacement gilts are reared.

Research in The Netherlands (NL) has shown that more space (considerably higher than required by legislation) and restricted dry feeding of gilts are critical factors to their success in group housing (Table 17). As shown in the previous chapter gilts are commonly overstocked on many pig units.

***TABLE 17. SPACE ALLOWANCE** (prior to service), **FEEDING AND AGE AT 1ST SERVICE OF REPLACEMENT GILTS ON 70 DUTCH FARMS WITH GROUP HOUSING** (mean of 10 best and of 10 worst performing)*

	10 worst farms	10 best farms
Gilts (m^2 per animal before AI)	1.4	1.9
Restricted feeding of gilts (vs. ad lib)	80%	100%
Dry-feeding of gilts (vs. liquid feeding)	70%	100%
Age at first AI	259 days	250 days

(source: Wageningen UR Livestock Research Report 283)

The belief that gilts need to be 'hardened off' in order to stimulate good performance has been shown to be incorrect and undoubtedly plays a huge role in the high levels of gilt wastage on many units. The practice is all too often used as an excuse to overstock gilts and/or keep them in poor accommodation etc. and one that we need to urgently address as the industry moves towards group housing. Owing to the additional stresses group housing places on an animals coping ability, gilts need to be at their very best in terms of health, walking/locomotory ability and body condition etc. on entry to the breeding herd. This is not achievable with gilts that were 'toughened up' in dark/badly designed/overstocked and/or poorly maintained pens.

II. LAMENESS

Teagasc Pigsys data indicates that 13% of gilts introduced to the breeding herd are removed before they even have one litter. Over 90% of these are culled and the remainder die. The two main reasons for gilt removal are failure to come on heat and leg/claw problems (i.e. lameness). Indeed, 32% of animals that are culled for lameness have produced only one litter (based on survey of culling reasons conducted by L. Boyle in 1997).

BOX 7

Lameness and limb lesions in replacement gilts: Case study on an Irish commercial farm

Over 6mths in 2008, 113 bought-in gilts were inspected within 3 days of entry to a 1000 sow commercial herd and within one week of service. P2 back-fat thickness was determined by ultrasound. Injuries caused by fighting at 12 locations were scored from 0 to 5 according to severity. The locomotion ability of each animal was scored according to Main et al. (2000) see figure 4, where score 1 = abnormal/shortened stride; 2 = uneven posture (i.e. limp); 3 = reluctance to bear weight on one limb; 4 = limb elevated and 5 = non-ambulatory. Wounds or swellings to the limbs were also recorded. Animals were randomly selected for inspection in equal proportions from four groups of approximately 30 animals. They were fed a wet diet twice daily from two long troughs in a concrete slatted area and had free access to a large solid concrete area for lying. No bedding was provided except when the solid area became soiled and shredded paper bags were used to dry it. After service gilts were transferred either to basket crates or to fully slatted pens in groups of 4 to 6.

ENTRY data were collected from 113 gilts and SERVICE data were available for 91 of these. However owing to practical limitations it was not possible to score the locomotory ability of all 91 gilts at first service. The mean back-fat depth at ENTRY was 9.9mm and at SERVICE was 16.8mm. The % of gilts affected by different classes of lameness, bursa to the limbs and wounds at each inspection are shown below. 100% of gilts were affected by fight lesions at ENTRY and their mean fight lesion score was 18.6 reflecting the fact that they were mixed on arrival at the farm. This score had decreased considerably when the gilts were inspected again at service (SERVICE fight lesion score=8.1) reflecting establishment of the dominance hierarchy. Nevertheless there was still evidence of fight injuries on 91% of gilts at the SERVICE inspection indicating that they were experiencing aggression at feeding.

The high proportion of animals affected by bursae on the hindlimbs indicates that these animals were kept

PERCENTAGE** [number affected/number inspected] **OF GILTS AFFECTED BY DIFFERENT LAMENESS SCORES, AT LEAST ONE BURSA TO THE LIMBS AND AT LEAST ONE WOUND ANYWHERE ON THE BODY AT EACH INSPECTION

Locomotion Score	Entry	Service
1	8.8 (10/113)	39.1 (27/69)
>1	7.9 (9/113)	31.9 (22/69)
Fore limb bursa	8.8 (10/113)	9.9 (8/91)
Hind limb bursa	39.8 (45/113)	41.8 (38/91)
Wounds	10.6 (12/113)	8.9 (8/91)

on unbedded solid or slatted concrete at the breeding unit. These lesions are chronic in nature and do not develop in the course of 3 days. Such bursae are linked to locomotory disturbances and may have implications for sow longevity. It is not possible to determine whether abnormal stride length (i.e. scores of 1) are associated with pain. However, as they reflect abnormal weight bearing they are likely to be associated with a biological cost because of the increased strain placed on the locomotion system. For this reason abnormal gait can be considered as an indication of reduced quality of life and as a predisposing factor to lameness. The prevalence of clinical lameness (i.e. scores >1) was low at under 8% on entrance of the gilts to the herd. However almost 32% of gilts had locomotion scores >1 at service which probably reflects injuries sustained from fighting at mixing and feeding. It must be cautioned that these findings are based on only one farm meaning that they cannot be generalised. Nevertheless they go some way towards explaining why so many animals are culled for lameness in the early parities. Clearly measures to reduce culling for lameness in breeding stock should be directed towards the young replacement animals and preferably well before they are purchased in or selected out from the finishers in the case of home reared animals. With the advent of group housing in 2013 the adaptation capabilities of gilts entering the breeding herd will be severely challenged. It will become even more important to ensure that they are sound at the start of their productive lives.

Recent research from the UK found that slatted flooring was the major risk factor for lameness across a large number of studies and across all classes of pigs. Concrete is a harsh and uncompromising surface. Concrete slats in particular are highly injurious to pigs fighting on them no matter what condition the slats are in. Obviously the feet of the most valuable animals in the herd must be protected from the floor if we are to stem wastage due to lameness. This should be from the point of selection or entry to the herd until service or better still until farrowing. The best way to achieve this is to keep gilts on deep straw bedding. Obviously there are other problems with the long term use of straw but its protective benefit for the hooves at least in the short term is undisputable. Rubber slat mats for pigs are also being developed and could offer a more feasible alternative in the future.

III. BEHAVIOUR

Replacement gilts must not only be 'sound', in good body condition and physiologically prepared for group housing they should also be prepared behaviourally. To ensure that they do not experience levels of stress that might be detrimental to reproduction and/or welfare on introduction to the breeding herd they need to develop excellent social skills during rearing. They can only learn these skills during development if they have enough space to perform normal types of social behaviour (as described in Chapter 3) such as showing submission by fleeing from socially dominant penmates. This could be one reason why providing gilts with space allowances larger than required by legislation was identified as a factor contributing to the success of group housing in Dutch herds. Although it is normally recommended to minimise re-mixing because it is so bad for pig welfare it may be useful for replacement gilts to be re-mixed at 6 months of age to better prepare them for group housing. Cull sows should be used as they can not inflict too much damage to the gilts and will also pre-expose them to pathogens in the breeding herd. Crucially gilts will learn a lot about the appropriate social behaviours to use during establishment of the dominance hierarchy from these older animals. If re-mixing gilts it should be done in a very safe environment where they are not in danger of injuring themselves and especially their feet (for example in specialised mixing pens - see Box 3).

It is also important to train gilts before service to the housing and feeding system they will encounter during gestation. Clearly this is of major importance when it comes to electronic sow feeding stations but may also apply to other feeding systems e.g. Trickle feeding.

BOX 8

Training gilts for entrance to electronic sow feeding (ESF) systems

- Dedicate one person to training gilts; this person should understand how animals learn and show good empathy towards pigs
- A training pen is essential: arrange so incoming animals can smell, see and touch the sows resident in the main group as this can help to reduce aggression at mixing
- On large units the training pen should have a similar layout to the one the gilts will be introduced to
- Ideally gilts should be able to watch experienced animals use the feed station as they will quickly learn from them
- On first introduction allow the gilts plenty of time to explore
- Encourage gilts to enter the feeder by scattering feed on the ground
- Patience is NB - Never push or force gilts into the feeder!
- Feeder needs to be very well-lit
- Gilts are normally trained in 2 days (if 'put' through feeder 3 times/day)
- Feed from 1900 to 0800h
- Train between 0900 and 1600h
- A minority of animals may never learn how to use the station and may have to be removed from the system

IV. NUTRITION

Feeding gilts a diet specifically formulated to meet their requirements as future breeding sows is another potential way of reducing lameness and thereby improving sow longevity. The majority of producers who 'home produce' their own replacement gilts feed diets formulated for finisher pigs until selection. Such diets are often too low in calcium and phosphorous which are necessary for good bone formation. Thereafter the animals are generally switched to a diet formulated for gestating sows. Ideally replacement gilts should be selected at 60kg and thereafter fed a 'developer' diet specifically formulated for their needs. Failing this replacement gilts should at the very least be switched to a sow diet from a minimum of 90kg. This is higher in calcium and phosphorous than finisher diets but also has a high energy:lysine ratio which favours fat deposition.

V. ADDITIONAL INFORMATION

You can find lots of additional advice in papers from previous Teagasc Pig Farmers conference proceedings on housing, nutrition, selection (leg conformation etc.), flushing, stimulation, serving etc. of gilts. Ex.:

- Sow culling and parity profile – Carroll, 1999
- Wastage of gilts and young sows – Martin, 2001
- Nutrition and management of the modern gilt – Malachy Young, 2003
- Sow longevity – Brendan Lynch, 2004
- Selecting gilts for increased sow longevity – Peadar Lawlor, 2005
- Gilt culling rate: A case study – Carroll and McKeon, 2009

8.2 CULLING SOWS

Prof. John Deen of the University of Minnesota recommends that we re-think our approach to culling sows. The strategy he recommends should be considered as we move towards group housing.

The culling rate for a particular herd combines 'good' and 'bad' culls (Table 18). Currently the proportion of sows removed from the herd voluntarily or for 'good' reasons is only 10%. It is obvious from the table that a higher proportion of 'good culls' is desirable and that we should strive to improve the ratio of good to bad culls rather than to simply reduce the culling rate. One way of doing this is to start paying more attention to biological, or specifically pathological data derived from the appearance or condition of the sow when making culling decisions. Prof. Deen refers to these as 'sow reasons'. Currently our focus is on quantitative data or productivity numbers such as born alive, stillborn, weaned etc. (i.e. card reasons).

TABLE 18. 'GOOD' AND 'BAD' CULLING DECISIONS

	Good culls *(successful or voluntary)*	**Bad culls** *(unsuccessful or involuntary)*
Reproductive age	Planned	Too young or too old (because of unavailability of replacements)
Productivity failure	None	Returns, low litter size, high pre-weaning mortality etc.
Welfare	Good	Poor (died, lame, anorexic, shoulder sores)
Value	Full sale value	Low sale value (underweight, casualty)
Replacements	Ready	Unavailable
Stage in reproductive cycle	At weaning	During gestation or lactation
Other	-	Death
% of removals	<10%	>90%

'Card reasons' are poor predictors of future sow productivity. This is particularly the case for young sows where the repeatability of poor reproductive performance is much lower than what we think. This means that we typically overestimate the efficacy of sow card reasons (i.e. productivity records), or essentially gamble, when we use them as a basis for culling decisions. Consider the decision to cull a young apparently healthy sow based on the fact that she has returned twice i.e. a 'card reason'. The 'gamble' means it is quite possible that we have underestimated her future productivity in which case a good sow was wrongly culled. However, this bad culling decision is made even worse by the fact that we are also taking a gamble on the replacement animal. The odds of her doing better than the cull sow are very low. In another scenario we retain a sow because her past productivity records were good but the sow is lame (sow reason). Because of the link between the inflammatory processes and pain associated with lameness and poor reproductive performance we have probably overestimated her future productivity. The odds of a replacement animal doing better than the lame sow are very high. Essentially both of these bad 'culling' decisions could have been avoided if 'sow' instead of 'card' reasons were the primary driver of the decision making process. The healthy sow that returned twice would be retained in the herd and the lame sow would be culled and replaced by a sow highly likely to outperform her. This model essentially challenges us to look more closely at our sows and not at their cards when making decisions on culling. This strategy is likely to become more relevant as we move towards group housing where our focus will need to be directed towards sow appearance/condition/health if the welfare problems described in Section 3.2 are to be minimised.

Sow reasons will always be a much better predictor of future productivity because pathologies are not alone associated with lower productivity but as in the case of lameness, are actually the drivers of lower productivity. These deviations are rarely assessed and even less likely to be recorded but it is important to note that they can often be treated. This is why a culling program based on sow reasons or pathologies rather than on card reasons or productivity will not only automatically improve the health and welfare of sows in the herd but also raises their reproductive performance. This concomitantly extends the sow's productive lifetime which lowers gilt production costs and reduces variation in gilt requirements. Ultimately productivity per sow space is improved.

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