Group housing systems for dry sows

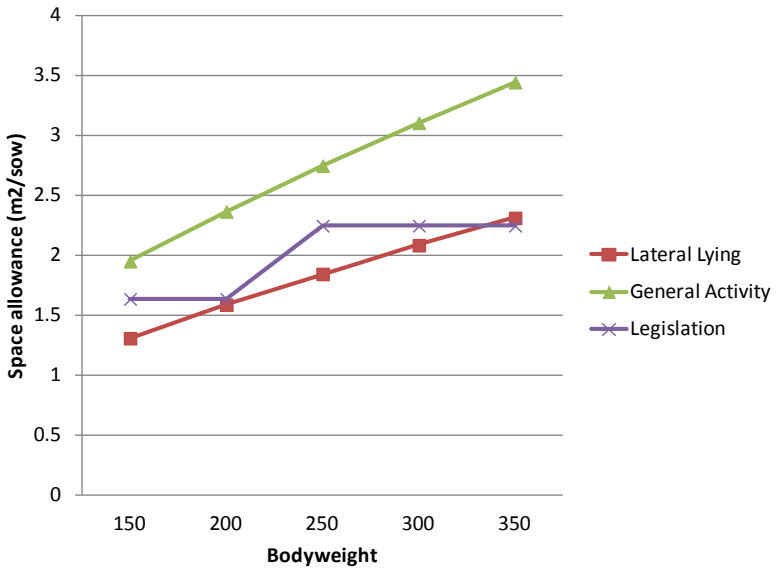
Comparison of various housing systems for dry sows has always proved difficult and inconclusive, because of the huge variation between systems (Spoolder et al., 2009). Factors such as bedding, group size, floor type, space allowance, static versus dynamic grouping, feed and water delivery and the level of stockmanship are some of the important variables with huge variations (McGlone et al., 2004). It is therefore more useful to consider factors which will impact the welfare of sows in group housing, and recommend ideal conditions for these factors if possible. The following factors are considered: provision of adequate space, solid floors and straw bedding, high fibre diets and manipulable material, and minimising aggression.

Provision of adequate space

Insufficient space in group housed sows exacerbates the negative consequences of aggressive behaviours at mixing and feeding, and can lead to chronic stress and high rates of skin lesions and physical injuries. Minimum standards for space allowance set down by EU legislation are currently 1.64m^2 per gilt and 2.25m^2 per sow (Council Directive, 2001), of which at least 0.95m^2 (gilts) and 1.3m^2 (sows) must be of continuous solid floor and a maximum of 15% is reserved for drainage.

The static space required for an animal to lie in lateral recumbency is given by the allometric equation $A=0.0457W^{0.67}$ (Petherick, 1983), where A is space in m^2/animal, W is the liveweight in kg and 0.0457 is a variable constant or 'k' value. The k value for lateral recumbency is very similar to that calculated for animals to move between standing and lying (Petherick, 2007), but does not allow for behavioural space (general activity) or interaction space (aggressive behaviour). Using the same extrapolation technique as FAWC (1995) for turkey stocking density (recommended 25 kg/m^2 at 5kg for active turkeys in barn systems) we can estimate the k value required for general activity to be 0.0608. Figure 1, illustrates the space allowance for sows of different bodyweights based on legislation, lateral lying and general activity. The legislative space allowance improves on that required for lateral recumbency, but is significantly less than that estimated for general activity, which varies from 1.95m^2 at 150kg to 3.45m^2 at 350kg. The space required for interaction would be higher still.

Figure 1. Space requirements (m^2/sow) for sows of different bodyweights according to i. legislation, ii. lateral lying and iii. general activity



There is evidence that increasing space allowance within the range calculated above benefits sow welfare (Spoolder et al., 2009). Increasing space allowance in dynamic groups from 2.25 to 3.0m^2 per sow led to a significant reduction in one-way aggressions and lower mean number of injuries when sows were observed 3 and 8 days after mixing (Remience et al., 2008), whilst increasing space in static groups of 5 sows had a positive effect on piglets born alive (Salak-Johnson et al., 2007). The largest litters occurred when the sows were kept at a space allowance of 3.3m^2 per sow, (compared to 1.4 and 2.3m^2) and sows provided with 1.4m^2 had the greatest lesion scores. Spoolder et al (2011) concluded that space allowance per sow should be reconsidered and further work as detailed by Petherick (2007) is needed.

Provision of solid floors and bedding

Solid floors and straw bedding have a positive impact on thermal comfort, hoof condition, lameness incidence and prevalence of skin lesions in sows (Spoolder et al., 2009), and are generally considered to be the most appropriate for sow housing (Tuyttens, 2005). Alternative substrates, such as rice husks and woodchip bark, maybe appropriate in warm climates where it is more important for the sow to keep cool.

Foot lesions and lameness are unfortunately common in sows; 76.8% of lactating sows observed across 71 farms in England were found to have foot lesions and 10% abnormal posture (Kilbride et al., 2010). The study showed that sows housed on slatted floors in pregnancy had a higher risk of heel flaps and abnormal posture than sows housed on solid flooring with bedding; there was also a positive association between foot lesions and abnormal posture, indicating these lesions were painful. Previously, Heinonen et al (2006), found 8.8% of lame sows and gilts (range 0-27.3%) in 21 Finnish herds; animals housed on slatted floors had twice the odds of being lame, and 3.7 the odds of being severely lame compared to animals on solid floors (with various types/amounts of bedding). Straw bedding should be kept dry and in good condition, otherwise there is an increased risk of toe erosion (Kilbride et al., 2010).

Straw bedding may not be an option for all pig producers, especially those converting from existing stall systems or those in geographic regions where straw provision is limited; interest has therefore grown in the use of lying mats to improve sow comfort. Sows preferred lying on mats to bare concrete (Tuyttens et al., 2008) and sows on mats in the feeding stall spent more time lying laterally, rather than sternally (indicating better comfort), and had lower total body lesion scores (indicating less aggressive interactions) (Elmore et al., 2010). Mats of 3 and 5mm-resistant based foam provided better claw cushioning and pressure relief than 1mm-resistant foam (Carvalho et al, 2009). Lying mats are not however considered a full substitute for straw (or equivalent substrate) bedding, as straw also provides an outlet for exploration, foraging, rooting, and chewing behaviours. The preference and lying posture of sows on mats has yet to be compared to that on straw bedding, particularly across a range of climatic conditions, and the consequences of mats on longer term leg health and skin lesions need to be evaluated (Tuyttens et al., 2008).

Provision of fibre in the diet and manipulable material

In conventional feeding systems, dry sows are fed a concentrated diet aimed at maintaining condition without excessively increasing backfat; they are subsequently fed approximately 2-3kg of food a day, normally as one meal. This provides little opportunity to fulfil feeding (satiety) and foraging needs, and leads to the feeling of hunger which is associated with increased levels of aggression, physical activity and the development of stereotypic behaviour (e.g. bar-chewing). Council Directive (2001) requires pregnant sows and gilts to be provided with sufficient amounts of bulky or high fibre diets, as well as high energy food, to satisfy hunger and the motivation to chew. Feeding a high fibre gestation diet also prepares sows (and particularly gilts) for the much higher feed intakes required in lactation (Guillemet et al., 2010). Straw bedding and forage based feeds (e.g. maize or grass silage) can help fulfil satiety and the foraging needs of the sow.

Various studies have investigated ways of improving satiety and reducing feeding motivation in sows (as evidenced by a reduction in sham chewing and increased resting behaviour) in non-bedded systems. Silage provision (1.9kg per day from rack)) reduced sham chewing and improved satiety (O'Connell, 2007), where as small amounts of straw (0.3kg straw/sow/day) did not (Stewart et al., 2008). High fibre diets (15.7% crude fibre) delivered through an ESF (electronic sow feeder) improved satiety and increased lying behaviour (Stewart et al., 2010), whereas moderate fibre diets (9% crude fibre) increased resting behaviour but required additional straw from racks to reduce sham chewing (Stewart et al., 2011).

It is likely that a combination of substrates and high fibre feed are needed to satisfy hunger in the sow and fulfil her foraging and exploratory needs. In the FAI system, Oxfordshire, UK, straw bedding provides comfort and warmth, and the sows root in the straw; woodchip bark provides oral stimulation and an area to cool down with wallows made at the drinkers; a bulky silage based diet provides gut fill and satiety.

Managing aggression

Social interaction, including aggression, can occur in any group-housing system for sows and cannot be eliminated, especially during mixing. Levels of aggression and its impact on stress, injury and lameness, and return to oestrus, are the main concerns of group housing (example McGlone et al., 2004; Karlen et al., 2007; Chapinal et al., 2010). The vulnerable period for fertility is during weeks 2 and 3 of pregnancy; mixing should therefore occur prior to this stage. There is a growing body of evidence however, that suggests mixing peri and pre-implantation in gilts, does not impair gilt reproductive performance (Soede et al., 2006; Krauss and Hoy 2011). Mixing sows later in pregnancy has negative impacts on the behaviour of their progeny: Daughters of sows mixed twice in gestation were more restless during parturition, and tended to bite at their piglets more than control daughters (Jarvis et al., 2006), and the progeny of mixed sows showed greater pain response to tail-docking (Rutherford et al., 2009).

Key factors to manage potential aggression are gradual familiarisation of unfamiliar animals (via fence contact), sufficient space and pen layout during mixing, and minimising opportunities for dominant sows to steal food from subordinates (Spoolder et al., 2009). Fighting for social dominance in a newly formed group is a temporary activity; consideration should therefore be given to temporary specialised mixing pens, which provide more space to escape aggressors and barriers to hide behind. Whilst static grouping is preferred, many producers opt for dynamic groups where social order is regularly disrupted; consider the presence of a male which is known to reduce aggression between sows, and pre and post feeding areas with the introduction of new sows post feeding when resident sows have already moved to the post feed area (as seen in the experiments of Stewart et al (2010). Irrespective of feeding system: floor feeding (including dump and spin feeding); trough feeding of dry or liquid feed (with varying partition lengths, and/or trickle feeding); ESF (static or dynamic grouping, with or without a pre and post-feeding yard), always provide sufficient access to the feeders so that sows of lower social rank are able to gain their required feed intake and competition over food is limited.

Consideration should also be given to the genetic selection of sows. Two behaviours (duration of involvement in reciprocal fighting, and delivery of non-reciprocal aggression) had moderate to high heritability, similar to that of growth traits (Turner et al., 2009). In future it should be possible to breed sows to be less aggressive, or to be less "stressed" by social interactions such as mixing, which could have beneficial effects for them, their piglets and subsequent generations.

Summary

In practice, producers throughout the EU have to develop group-housing systems for their sows. Scientific guidance is limited on whole systems, but aspects of good design and management have been identified. These are provision of sufficient space, solid floors with bedding (preferably straw), high fibre diets and

foraging material, and minimising aggression especially during mixing (preferably via consistent group composition and the reduction of competition for food). Finally, farmer attitude and knowledge transfer are key components to the successful adoption of well designed and managed group housing systems (de Lauwere et al., 2011).

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