The Serious Welfare Problems Associated With Housing Sows in Gestation Stalls and the Immediate Need for Implementation of Group-Housing Systems

"Animal producers will never convince the public that they care about their animals if they house them in stalls where they can't turn around for months."
—Professor David Fraser, University of British Columbia (Kaufman 2001)

Introduction

At any given moment, there are approximately 6 million breeding sows in the U.S., making up more than 10 percent of the entire U.S. pig population (National Agricultural Statistics Service 2002). During commercial production, pregnant sows are kept predominantly in individual stalls so small that basic movements, such as turning around, are impossible. These stalls, called gestation stalls or gestation crates, are usually not much larger than the sow herself—about 7 feet long by 2 feet wide (Kaufman 2001)—and lead to a variety of animal welfare problems. Sows are also sometimes tethered by the neck in open-ended stalls, leading to similarly restrictive conditions in which they "have about the same space as in a stall and cannot turn around" (National Pork Board 2002). Producers tend to keep sows in these conditions for most of their pregnancies, which last an average of 115 days or a little more than 16 weeks, ostensibly to monitor individuals in a more cost- and labor-efficient manner. Just prior to giving birth, sows are typically moved to farrowing stalls—further restricting their movements, theoretically to reduce piglet crushing. After weaning, the sows are, once again, impregnated and returned to gestation stalls. This process continues for several consecutive parities until the sows are no longer reproductively viable, and they are sent to slaughter—after approximately five or six litters (Krieter 2001) or, in other terms, three to five years (Rollin 1995). As a result, sows spend much of their lives—month after month—in such restrictive conditions that the simple act of standing up becomes the highlight of their day.

Animal welfare scientists have conclusively shown that gestation stalls are both physically and psychologically detrimental to sows and that group housing that allows individuals to move freely and to interact with others in a large area—often having subdivisions for feeding, dunging, and sleeping—can improve both welfare and cost efficiency. In fact, so much compelling evidence for this exists that the European Union's (EU) Agriculture Council, consisting of agriculture ministers from the EU's 15 member countries, recently issued a directive addressing gestation stalls (Council Directive 2001/88/EC, herein referred to as the "EU Pigs Directive") that will apply to newly built facilities as of 2003 and all other facilities as of 2013. The directive bans the use of stalls after the fourth week of pregnancy and bans tethering completely in order to, in its own words, "move towards a better standard of animal welfare" (European Commission 2001). Other countries, including Denmark, Finland, Holland, Sweden, and the United Kingdom, have issued laws prohibiting or phasing out the use of gestation stalls and tethering during most of a sow's pregnancy for welfare reasons. In Canada, many producers are switching to group housing, and in the U.S., consumers have made it clear that they are opposed to gestation stalls. For example, more than 600,000 voters in Florida alone initiated a referendum on the 2002 ballot that would prohibit gestation stalls, and surveys indicate that up to 70 percent of American consumers are willing to spend extra on more humanely raised products (Rampton 2001).

It is important to note that the Scientific Veterinary Committee (SVC) report entitled "The

Welfare of Intensively Kept Pigs" (SVC 1997) is cited frequently herein because of its authoritative and thorough discussion of relevant topics. In fact, the Animal Welfare Section of the SVC enlisted Europe's top academic pig welfare experts to prepare the report in response to a request by the European Commission to develop specific recommendations for, among other things, sow housing. The report remains an influential piece that has helped shape current animal welfare regulations, including a complete phasing-out of gestation stalls in the European Union.

Physiological Consequences of Group Housing vs. Gestation Stalls

Infections, morbidity, and mortality: Bäckström (1973) was one of the first to compare different rearing systems and found that stalls led to higher rates of painful conditions such as mastitis, metritis, and agalactia than did group housing and that sow morbidity was higher—almost double—at farrowing for stall-housed sows. Broom (1989, p 104) reports that "confined sows may also be more subject to urinary diseases …" Tillon and Madec (1984) report that urinary tract disorders increased in France during the period that sow confinement was becoming common, leading Madec (1984, cited in Broom 1989) to suggest that the problems may be a direct result of sows' having to lie in their own feces. Madec (1985, cited in Broom 1989) went on to find that tethered sows drink and urinate less, resulting in concentrated urine that is more likely to cause bacterial infections. Mortality, which can reach levels up to 20 percent in stalls in poorly managed systems (Hemsworth 2001), can be held under 2 percent in well-designed group housing (Rampton 2001).

Lameness and injury: Bäckström (1973) found that there was a higher incidence of injuries in confined sows (6.1 percent) than in group-housed sows (0.8 percent). Tillon and Madec (1984) reported that in a quarter of the units using tethers, more than 20 percent of the sows had serious lameness. Marchant and Broom (1996) found that stall-housed sows had leg bones which had only two-thirds of the strength of those of group-housed sows. They also found that stall systems led to an overall "reduction of muscle weight and considerable reduction of bone strength" (p 105) resulting in increased susceptibility to broken bones and other injuries. Furthermore, they suggested that "with weaker muscles, there is a greater chance of the sow slipping during lying and standing and incurring physical damage." Grondalen (1974) found that pigs who exercised (e.g., group-housed sows) were less likely to fall after slipping than those who did not (e.g., stall-housed sows). Marchant and Broom (1993) suggested that the decrease in muscular strength from stalls caused difficulty in the most basic movements, such as standing up and lying down. It was speculated that this could lead to increased piglet mortality during farrowing since the sow is less in control of her movements (SVC 1997, §5.2.2). Numerous other studies have confirmed that lameness and joint problems are far more common in stall-housed sows (Bäckström 1973; Tillon et al. 1984; Fredeen and Sather 1978). The inactivity associated with being confined to a stall can also result in painful pressure sores, similar in nature to bedsores in human hospital patients, which can be greatly reduced in group-housing systems. Broom et al. (1995) found that, in their study, 16 percent of sows in stalls developed sores on their legs, which made it difficult to stand up and lie down, and that stalls caused more health problems, in general, than group housing.

Aggression: While aggression can sometimes be a problem in poorly maintained group-housing systems, in well-designed systems, it can actually be reduced to levels that lead to fewer problems than in stalls. Broom et al. (1995, p 369) found that group housing resulted in lower

proportions of agonistic interactions in which a sow used aggression and aggressive behavior of a high intensity and that "stall-housed sows were also more aggressive than group-housed by the fourth pregnancy …" It also found that sows had more social interactions under group housing and a greater proportion of agonistic interactions in which a clear result occurred. This is important considering that others have found unresolved agonistic interactions to be an additional source of stress for sows (Barnett et al. 1987a) as well as an additional source of fear and frustration (SVC 1997, §5.2.3).

Cardiovascular fitness: Overall fitness is improved in group-housing conditions where exercise is actually possible. Marchant and Rudd (1993) confirmed this by finding cardiovascular fitness to be less in stall-housed sows that those in group housing. The SVC (1997, §5.2.7) concludes that "this is significant in the situation where many pigs which die during transport are diagnosed as having cardiovascular problems."

Serious health problems, like this pressure sore on a sow awaiting slaughter, make life painful for sows housed in stalls.

Psychological Consequences of Group Housing vs. Gestation Stalls

Stereotypies: The Washington Post (Kaufman 2001) recently reported that "sows in stalls tend to display behavior often associated with animals experiencing extreme boredom or stress. The sows spend significant time biting the bars in front of them, chewing without food, and pressing their water bottles obsessively—but never rooting in dirt, which makes up much of instinctive pig behavior." The SVC (1997, §5.2.2) found that stereotypies—a term used to describe abnormal, repetitive behaviors—"indicate that the individual is having difficulty in coping with its environment and hence that its welfare is poor" and that "the extent of stereotypy gives an indication of how poor the welfare is." Broom (1989, p 106) writes that "there is no doubt that an animal showing stereotypies for a long period is very abnormal in its behaviour. The stereotypies are an indicator of poor welfare, and they are frequent in most sow stall and tether units."

Many authors have identified stereotypies for sows kept in stalls or tethers to include bar-biting, sham-chewing, drinker-pressing, head-weaving, nose-rubbing, and tongue-rolling. Cronin (1985, cited in SVC 1997) found that 100 percent of the confined sows that he studied displayed stereotypies. Others who have looked at stall-housed sows have found that a significant portion of a sow's time is spent displaying these abnormal behaviors (Jensen 1981; Broom and Potter

1984; Blackshaw and McVeigh 1984, cited in SVC 1997). Another study of tethered sows (Cronin and Wiepkema 1984, cited in Broom 1989) found that stereotypies were performed for, on average, 80 percent of daylight observation hours. The SVC (1997, §5.2.2) concluded that "in every detailed study of sows in stalls or tethers, a substantial level of stereotypies has been reported indicating poor welfare in the sows." To make matters worse, research has shown that stereotypies increase with each parity—up to tenfold by the fourth parity—indicating that the suffering caused by being confined to a stall becomes progressively worse with each pregnancy (Stolba et al. 1983; Cronin and Wiepkema 1984; von Borell and Hurnik 1991; Broom et al. 1995).

Comparative studies such as Broom et al. (1995) found that stall-housed sows displayed stereotypies for up to 50 percent of the time during observation hours compared to 4 percent of the time for group-housed sows who used an electronic feeder. Vieuille-Thomas et al. (1995) also confirmed this, finding that a lower proportion of sows developed stereotypies in group housing versus stalls. Mendl et al. (1992) reported that sows in stalls spent 8.2 percent of their time engaged in sham-chewing, a clear stereotypie, compared to 0 percent for group-housed sows who used an electronic feeder. The SVC (1997, §5.2.2) points out that stereotypies are "extremely rare in sows kept in complex environments," thus indicating that psychological welfare is dramatically improved by taking them out of stalls. In fact, it reports that the number of animals displaying stereotypies is close to zero in well-designed group-housing systems "where the sow can exercise, manipulate materials or root and interact socially."

Stress: Cortisol levels have been shown to be effective indicators of stress and welfare (Broom 1989), with higher levels correlating to poorer welfare. Bergeron et al. (1996) reported that sows kept in enclosures large enough to allow for turning around had lower cortisol levels than those kept in traditional stalls. Numerous other studies have found that sows in stalls and sows who are tethered have higher cortisol levels than those housed in groups (Barnett et al. 1984, 1985, 1987a, 1987b; Janssens et al. 1995). Tethering is even worse than stalls, in this sense, as Barnett et al. (1981) recorded higher plasma cortisol levels for tethered sows as compared to stall-housed sows.

Frustration: The SVC (1997, §2.1) concludes that "studies of wild boars, feral pigs and of domestic pigs kept in semi-natural enclosures are the main sources for understanding the natural behaviour of pigs … [and] comparisons reveal that no major changes in basic behavioral systems have occurred during domestication." Marchant and Broom (1996, p 105) found that "confinement [in stalls] has resulted in alteration or prevention of many of the sow's normal behaviours [and] increases in abnormal behaviour and in various other indicators of poor welfare." Another study (Broom et al. 1995, p 381) suggests that "stall-housed sows encountered … frustrating situations more often than those housed in groups, due possibly to their inability to satisfy motivation to move, forage, and express other forms of behaviour" and, in short, that there were "more welfare problems for sows housed in the stalls than in either group-housing condition."

Spinka et al. (1998) confirmed that female pigs do not like being kept in stalls and found that, when given the choice, gilts preferred short durations of confinement in stalls over longer durations of confinement. In numerous studies, sows have also been shown to spend a significant

amount of time exploring their environments and looking for diverse opportunities, something that they obviously cannot do in crates (Jensen 1980; Stolba and Wood-Gush 1989; Wood-Gush et al. 1990). According to the SVC (1997, §5.2.1), "when sows are put into a very small pen, they indicate by their behavioural responses that they find the confinement aversive" and "in general, sows prefer not to be confined in a small space." Van Putten (1977, cited in Broom 1989) reported that confined sows are not able to groom naturally, and Broom (1989) states that, under such conditions, they are also unable to thermoregulate normally, interact with other sows or escape "hazardous stimuli."

Further evidence indicating high levels of frustration in stall-housed sows comes from the concept of a "rebound effect," which is defined by Bogner (1984, cited in SVC 1997) and Nicol (1987) as a situation in which frustration is released in high-intensity behavior once a restriction has been removed. This is clearly seen in sows, as the SVC (1997, §5.2.1) reports: "If moved on the farm after spending some time in a stall or tethered, sows attempt to move around and investigate open spaces rather than doing what the person moving them wants them to do."

Depression: It has been found that, aside from stereotypies, stall-housed sows have very low activity levels when compared to group-housed sows (Ekesbo et al. 1978; Jensen 1979, 1981; Gravas, 1982; Carter and English 1983; Wood-Gush 1990, cited in Fraser and Broom 1997). In fact, group-housed sows can be more than four times as active (SVC, §5.2.2). Van Putten (1980) suggested that confined sows are "apathetic" to their surroundings and, in a series of studies, Broom (1986a, 1986b, 1987) found that sows in stalls were less responsive to stimuli, other than food, than group-housed sows—including the pouring of water on a lying (but awake) sow's back. Fraser and Broom (1997, p 275) conclude that "these studies provide quantitative evidence to show that confined sows are less responsive to events in the world around them than are group-housed sows." This lack of activity and unresponsiveness are indicative of deeper psychological problems including depression, which Mendl et al. (1992) suggest may be a problem for stall-raised sows. The SVC (1997, §5.2.2) concludes that "since the extent of the inactivity and unresponsiveness indicates abnormal behaviour, the sows may well be depressed in the clinical sense, and poor welfare is indicated."

Some sows spend up to 25 percent of their time engaged in bar-biting (Rampton 2002)—which is an abnormal behavior that is indicative of poor welfare.

Types of Group Housing

We have seen that, in general, group housing results in improved sow welfare on a number of important levels. While management of group housing may, at times, be more involved than stall-housing, it is something that "most pig farmers can manage" (correspondence from Professor DM Broom dated Sep 26, 2002; unreferenced). There are, however, many different systems available, with some being better for welfare than others, so it is important that whichever system is chosen is well-designed and operated. Some of the more common group-housing systems include:

Floor feeding: Food is dumped or distributed directly on the floor or in troughs, which can result in high levels of aggression as sows fight over rations (Csermely and Wood-Gush 1986), and is not recommended (Fraser and Broom 1997).

Individual feeding stalls: Sows enter individual stalls during feeding times and are sometimes locked in to prevent other aggressive sows from displacing them. Sows under this system may be easier to manage than those using other group-housing systems (correspondence from Professor DM Broom dated Sep 26, 2002; unreferenced).

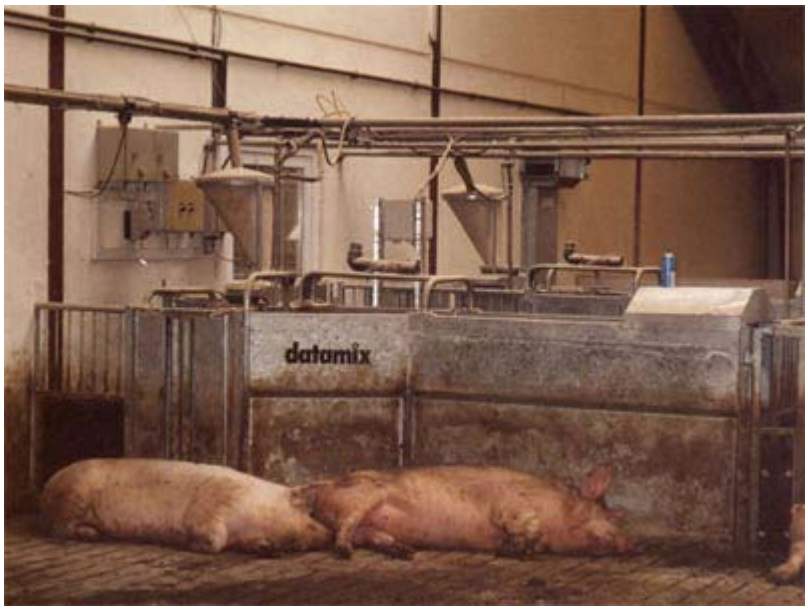
Trickle feeders: The mechanism delivers food to feeders or troughs slowly, sometimes at the rate of the slowest feeder, in order to prevent aggressive individuals from leaving their own spot to take another sow's ration. Researchers at the U.S. Department of Agriculture's Agricultural Research Service (www.liru.asft.ttu.edu) and Texas Tech University are currently looking into these systems for use in the United States (Comis 2002).

Outdoor free-range systems: Pigs are allowed access to pasture at all times and have the ability to fulfill many of their natural behaviors such as rooting and nest-building. Niman Ranch (www.nimanranch.com) is one example of an American company that is successfully using this system.

Electronic sow feeders (ESF): This system is described in greater detail because of its increasing popularity in Europe and North America and because a number of academic studies have looked at its positive impact on welfare and cost-efficiency. Typically, an ESF is a computerized station which sows are allowed to enter after a scanner reads the transponder that is embedded in their ear tags. The gate closes once the sow is inside so that she is able to eat unimpeded—without having to worry about competing with others for food. The ESF computer dispenses a prescribed amount of food into a trough, and the sow can decide when she is ready to exit the station. It is important for the ESF to have a separate exit gate, so that the sow can leave without confronting others who are waiting to get in. Most ESFs allow for computerized recording of each sow's intake for review at the end of the day and, if programmed to do so, can also separate sick or

injured animals by opening a separate gate that leads to an isolation pen rather than back to the group. Each station typically serves between 40 and 60 sows and allows for group housing in large areas that can further be divided into dunging, isolation, and lying areas. Sows who are using the feeders for the first time must be trained to do so, but with good management, this can be achieved in as little as two weeks and with minimal complications (personal visit to a Danish sow farm called Allelieve Hagvaar on Jan. 23, 2002; unreferenced).

Hodgkiss et al. (1998) scored pregnant sows who were housed in groups with an ESF according to the injuries that they incurred over an 18-month period and found lesion scores to be low and total injury scores to be decreasing with parity. Broom et al. (1995) reported that, by the fourth pregnancy, sows using an ESF were able to actively avoid agonistic interactions, and no fights were observed. Mendl et al. (1992) found that sows in stalls spent 8.2 percent of their time engaged in sham-chewing, compared to 0 percent for those using an ESF. Fraser and Broom (1997) looked at a number of studies that described ESF systems and found that—as long as they were well designed to include, among other things, efficient training of sows, a sufficient number of feeders, stable groups, and a good bedding area—there were no significant welfare problems. It is also important to note that backup electricity generators and detailed emergency protocols—for use in situations in which mechanical or power failures occur—are crucial to the success of ESF systems.



Sows are able to move freely, engage in more natural behaviors, interact with others, and experience less physiological and psychological trauma under group-housing conditions with this particular system using an electronic sow feeder.

Costs of Group Housing

The cost of switching from gestation stalls to group housing varies depending on the system that is being implemented. It is important to keep in mind, however, that all systems, including stalls,

require replacement after a certain number of years—making investment in new housing equipment inevitable in all circumstances. Furthermore, building, machinery, and labor costs—that is, those areas that would most significantly be affected by a switch—tend to make up a relatively small portion of total operating costs (i.e., feed costs are the greatest costs in any system). Taking these factors into consideration, we can see that, from an economic standpoint, a switch will have relatively little impact in terms of long-term costs, especially if the existing stall equipment is already near the end of its functional lifetime. Furthermore, practical experience has proved that group housing is, indeed, economically viable, as shown by the emergence of such systems in Europe, under which more than four million sows are raised (Turner 2000).

The SVC (1997, §6.3.6) compared the investment costs of an ESF system to those of individual housing and found that "total investment per sow decreases for the group housing system" since "expensive crates are not needed anymore." Specifically, they found that the building investment per sow decreased by 2.03 percent, housing cost per sow decreased by 2.14 percent, and "cost price per kg of fattening pig" decreased as well—leading to an 8 percent increase in income. Another recent estimate (Turner 2000) found that changing from stalls to group housing with straw would only add the equivalent of approximately 1.5 cents to the cost of producing 1 pound of pig flesh, and even less if straw distribution were to become fully automated or if sows were to eat much of the straw—which commonly occurs and saves on the labor costs of manual removal (SVC 1997). A meta-analysis of five European reports (Turner 2000) found that a switch to group housing generally resulted in either a decrease in investment costs or, if straw was used, only a minimal increase in running costs.

Studies have also shown that sow productivity increases as a result of group housing. Fahmy and Dufour (1976) found that individual pens can lead to fewer sows becoming pregnant after attempted service than group housing. Broom (1989, p103) reports that "many farmers with sows in stalls or tethers experience difficulty in getting some of their gilts or sows pregnant," Jensen et al. (1970), and Mavrogenis and Robinson (1976) found that tethered and stalled sows came into first estrus four or more days later than group-housed sows. Numerous other studies have shown that sows return to estrus more quickly if raised in groups rather than individually in stalls (Sommer 1979; Sommer et al. 1982; Hemsworth et al. 1982, cited in Broom 1989). Bäckström (1973) and Sommer et al. (1982) found that confined sows were more prone to stillbirths. And Bäckström (1973) and Vestergaard and Hansen (1984) found that farrowing times were significantly shorter for group-housed sows than for those raised in stalls.

While there are many factors to take into consideration, including the amount of space allotted per sow, it has been shown that, in general, group housing leads to increased labor income and increased production from decreased housing costs, especially when using an ESF system. If straw is added to the system, labor costs increase minimally but may be offset by public relations gains that result from meeting consumer demand for more humane rearing methods.

Minimum Requirements for Group Housing

Clearly, group housing is better for sows on a number of levels; however, it is crucial that certain practices and management techniques be used in conjunction with whichever system is ultimately installed in order to optimize improvements and avoid other sources of poor welfare. Some of the most important areas to address are:

Aggression: Overall, the SVC (1997, §5.2.3) concludes that "farmers can successfully manage sows in group housing systems without much aggression provided that the group is kept relatively stable, in that sows return to the same group after farrowing and new animals are brought in only when necessary, mixing is managed carefully, the feeding system minimizes competition situations and there are adequate degrees of environmental complexity and alternative low density food source." More specifically, each of the following must be provided:

- *Noncompetitive feeding mechanisms* must be carefully designed, since it has been shown that when there is open competition for food in group-housing systems, aggressive behavior is more prevalent (Csermely and Wood-Gush 1986; Broom 1989). The SVC (1997, §5.2.11) recommends that "sows in groups should be fed using a system which ensures that each individual can obtain sufficient food without being attacked, even when competitors for the food are present." The EU Pigs Directive echoes this sentiment by requiring that "sows and gilts kept in groups must be fed using a system which ensures that each individual can obtain sufficient food even when competitors for the food are present." Electronic sow feeders and individual feeding stalls are examples of systems that can achieve this. It is also important that the system is capable of delivering the entire day's ration in one sitting, as this has been shown to reduce aggression around the feeder-entrance area (correspondence from Professor DM Broom dated Sep 26, 2002; unreferenced).

- *Stringent space requirements:* Wood-Gush et al. (1990) found that sows prefer social contact and will actually interact in a friendly manner as opposed to an aggressive one when provided with enough space and general enrichment. Therefore, overcrowding must be avoided at all costs. While the EU Pigs Directive requires at least 2.25 square meters per sow once stalls are completely phased out, other welfare experts believe that at least 3.5 square meters is needed (correspondence from P Stevenson dated May 22, 2002; unreferenced).

- *Stable groups* must be maintained with minimal introductions of new individuals, and if introductions are absolutely necessary, they should be supervised closely to minimize fighting (Arey and Edwards 1998).

- *Enrichment opportunities* should be readily available, such as access to rations of unchopped straw as mentioned in the "Bedding" section below. Also, occupational materials, such as bowling balls and toys, can help reduce aggression in pigs (Blackshaw 1997), while straw, logs, and branches have been shown to reduce behavioral disturbances among young pigs (Petersen 1995). One particular device, produced by Ikadan (www.ikadansystem.com), involves a number of hanging plastic chew sticks and is designed to divert pigs from tail-biting and other aggressive behaviors.

- *Remote areas:* There should be additional rooms adjacent to the main room or solid partitions within the main room to create remote areas so that "sows have an

opportunity to hide from or otherwise avoid those individuals which might attack them" (SVC 1997, §5.2.1).

- *Genetic selection* for non-aggressive traits: Dr. Temple Grandin (2001) of Colorado State University suggests that aggression can be reduced by using less aggressive types of pigs and that genetics should be taken into consideration when designing group housing.

Bedding: Matthews and Ladewig (1994) reported that pigs preferred bedding materials second only to food. Van Rooijen (1980, 1981, 1982, cited in SVC 1997) and Hutson and Haskell (1990) found that pigs will work for access to earth and bedding material. Wood-Gush and Beilharz (1983) found that the presence of earth in pens reduced stereotypies—indicating that its presence improves welfare and provides enrichment opportunities. Other studies (Jongebreur 1983; Gloor and Leimbacher 1984; Grauvogl 1987, cited in Broom 1989) found that straw is a much-desired material for bedding and enrichment. Petersen et al. (1995) observed young pigs over the course of 14 weeks and concluded that behavior disturbances were reduced when straw, logs, and branches were provided. Beattie et al. (1996) found that the addition of peat and straw helped reduce nosing and tail-biting behavior among pigs kept in pens.

As for studies regarding sows, Arkenau et al. (1996, cited in SVC 1997) reported that the presence of straw reduced aggression in group housing. Andersen and Boe (1999) found that straw bedding was advantageous in preventing leg problems. Fraser (1975) and Vestergaard (1981) found that if unchopped straw is made available to confined sows, stereotypies are reduced. Numerous other studies have found that the presence of straw improves welfare for group-housed sows, including reduced aggression and fewer stereotypies (Weber and Friedli 1991; Burbidge et al. 1993; Olsson and Svendsen 1993; Schaffer-Muller et al. 1996, 1997 cited in Turner 2000; Whittaker et al. 1999). The SVC (1997, §5.2.11) recommends, in no uncertain terms, that "all sows should have access to soil for rooting or manipulable material such as straw." And the EU Pigs Directive requires that "… sows and gilts shall have permanent access to manipulable material at least complying with the relevant requirements of the Annex," which defines these materials as "straw, hay, wood, sawdust, mushroom compost, peat or a mixture of such, which does not compromise the health of the animals." Clearly, a separate lying area, with sufficient bedding material, is essential for improved welfare and should be maintained at all times so that sows can lie together and interact socially.

The use of a straw-based manure system, as opposed to a slurry-based one, has the added bonus of being less detrimental to the environment. Nicholson et al. (2000) showed that straw systems produce less ammonia during storage and distribution and result in less leaching of nitrates (Chambers et al. 1999, cited in Turner 2000). Furthermore, straw systems may sometimes be less expensive to install, as reported in an estimate by The French Institut Technique du Porc, which found lower investment costs for group housing with straw than for group housing with slatted floors (Rousseau and Salaün 1998 cited in Stevenson 2002).

Floors: It is crucial that sows be provided with a significant area with unslatted floors where they can comfortably stand or lie. Slatted floors should be reserved for the dunging area and kept to a minimum, as it has been shown that they can lead to foot lesions in sows at almost double the rate of unslatted floors (Bäckström, 1973). Smith and Robertson (1971) also warned that poor,

slatted floors could lead to serious foot and leg problems. Broom (1997) concludes that the incidence of sow lameness is high on slatted floors. The EU Pigs Directive requires that each sow have access to at least 1.3 square meters of unslatted, continuous solid floor (0.95 square meters for gilts).

Food restriction: Pregnant sows, like other breeding animals used in agriculture, are victims of production practices that are aimed to create hungry individuals who grow rapidly. With a propensity to gain weight quickly, sows would quickly become obese if left to eat ad libitum, which could then lead to a number of fertility problems. Rather than genetically developing less hungry animals for breeding purposes, however, producers typically resort to restricting feed, which results in a state of perpetual hunger for sows.

The SVC (1997) reports that "the food provided for dry sows is usually much less than that which sows would choose to consume, so the animals are hungry throughout much of their lives." In order to help alleviate this suffering, the SVC recommends providing bulky or high-fiber foods as well as high-energy foods. By providing bulky foods, such as straw, wheat bran, corn cobs, or oat hulls, it is also possible to reduce the stress associated with the lack of manipulable material (see "Bedding" section). Broom et al. (1995, p 381) found that "the provision of straw or similar roughage is clearly desirable for sows given a restricted concentrate diet." Robert et al. (1997) studied the effects of bulky foods on female pigs and concluded that they do reduce hunger and post-feeding stereotypies. Indeed, the EU Pigs Directive requires that in order "to satisfy their hunger and given the need to chew, all dry pregnant sows and gilts must be given a sufficient quantity of bulky or high-fibre food as well as high-energy food."

Stockmanship: Needless to say, stockmanship is a critical element in any group-housing system, and only workers who make sow welfare a top priority should be employed. The SVC (1997, §5.2) aptly summarizes that "poor stockmanship can lead to poor welfare in any system."

Conclusion

The damage to animal welfare caused by gestation stalls can no longer be ignored. The SVC (1997, § 5.2.11), whose recommendations helped lead to the phasing out of stalls throughout the European Union, concludes that "group-housed sows show less abnormality of bone and muscle development, much less abnormal behaviour, less likelihood of extreme physiological responses, less of the urinary tract infections associated with inactivity, and better cardiovascular fitness. … Since overall welfare appears to be better when sows are not confined throughout gestation, sows should preferably be kept in groups." Many countries have already proved, in practice, that group housing is not only commercially feasible but, in some cases, more cost efficient—especially systems featuring electronic sow feeders.

It is critical that U.S. companies look toward immediately eliminating the use of stalls and tethering and work to provide a more comfortable and spacious environment to reduce the suffering of sows. Whichever group-housing system is used, however, must meet certain minimal requirements including: measures to reduce aggression, such as noncompetitive feeding mechanisms; stringent space requirements; stable groups; enrichment opportunities; remote areas; genetic selection for non-aggressiveness; access to soil and bedding material such as straw; areas with unslatted floors, particularly in lying areas; daily provisions of bulky and high-

fiber foods; and workers who consider sow welfare to be a top priority. Well-designed group-housing systems will allow producers to improve the mental and physical health of sows as well as partially satisfy the public's overwhelming demand for more humane production practices. These systems should be adopted without further delay.

Please direct any questions or comments regarding this report, which was completed on August 16, 2002, to Cem Akin at 757-622-7382.

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