

SOW HOUSING: WHAT ARE MY OPTIONS FOR FARROWING AND GESTATION?

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1. Introduction

The modern pork producer must wear multiple hats; they need to be a steward of their animals and land, they have to make a profit and weather tough economical climates, they must continue to have an appreciation of technological advancements being made in swine health, nutrition and manufacturing goods, and be cognizant of the politics which could threaten the way that they have traditionally farmed.

One metamorphic area within North America over the past 10 years has been a renewed and passionate interest in farm animal welfare throughout the entire production chain from humane; Humane Society of the United States [HSUS], Animal Welfare Institute [AWI] and Humane Farm Animal Care [HFAC]) animal rights; People for the Ethical Treatment of Animals [PETA], Animal Liberation Front [ALF], the producer; National Pork Board [NPB] and the National Pork Producers Council [NPPC], and marketing groups; Food Marketing Institute [FMI] and National Council of Chain Restaurants [NCCR].

Welfare initiatives in place today range from on *farm assessment programs* (Swine Welfare Assurance Program), *certification programs* (Free Farmed and Certified Humane – Raised and Handled by Humane Farm Animal Care) and *marketing guidelines* (FMI and NCCR). To complicate matters further, numerous *legislative actions* (Florida and Arizona) and past and current legal challenges (California, Colorado, Maryland and New Jersey) are being directed towards the pork industry at varying success.

Internationally, since 2003 the global welfare community has begun efforts to formulate and agree upon standard welfare guidelines through the *Office International des Epizooties* (OIE). The OIE traditionally has focused on animal health; the identification, containment and eradication of both domestic and foreign diseases. The OIE has 166 member countries, ranging from developed to developing status. To date the OIE is considering four areas of farm animal welfare – these are slaughter, land transportation, sea transportation and mass euthanasia pertaining to a disease outbreak.

On top of all the above challenges outlined previously, the every day *consumer* of meat derived produce knows very little about animal agriculture and today's way of raising pigs, cattle and poultry and this can create a dangerous vacuum of knowledge that can be filled by entities that maybe in direct conflict with the pork industries agendas and aims.

2. Objectives

This paper will (1) discuss some recent challenges imposed onto the US swine industry in regards to the gestation sow (2) identify different farrowing systems available to a producer and (3) provide comparisons of sow and litter behavior and performance in differing farrowing systems.

3. Gestation systems

Gestation sow housing methods are a contemporary animal welfare issue particularly in Europe and North America. Selected European countries and the European Union have banned

or are phasing out the use of stalls and tethers for gestating sows. Some US markets seek pork from systems that do not individually house sows (Niman, 2007; Wholefoods, 2007).

Extensive reviews have been conducted and published in regards to the well-being of the individual sow when housed under different gestation systems (Barnett et al., 2001; McGlone, et. al., 2004; SVC, 1997) and so the author encourages the reader to review these works. All these reviews in a nutshell have stated that all systems have their weakness and strengths, the management of the system is critical and the science does not emphatically support one system over another. So what system do US pork producers prefer to use? In Figure one the most popular way to house the sow is in gestation (64%) and farrowing (81%) stalls respectively (NAHMS, 2000).

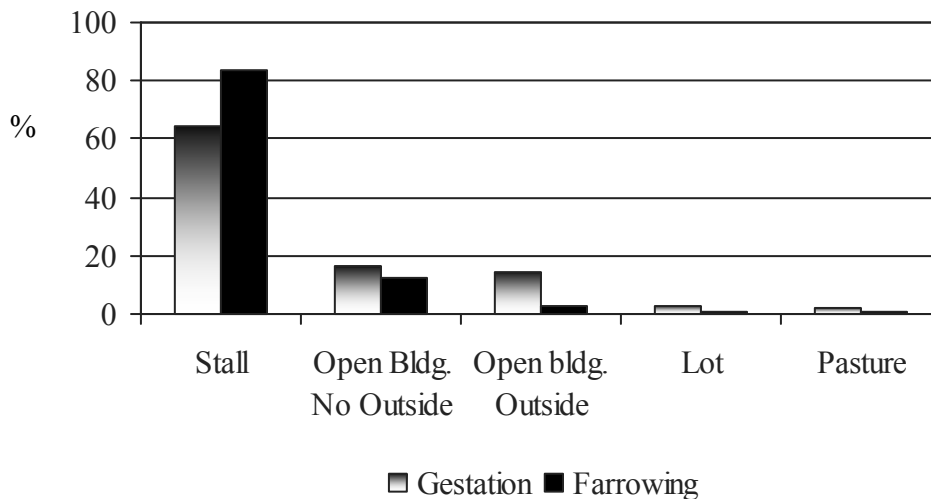


Figure One: Housing systems for sows in the US. For sites that had specified production phases, percent of pigs by type of facility (NAHMS, 2000).

4. Challenges to the US swine industry 2002 – 2007

Two notable legislative events against the US pork industry occurred in 2002 and in 2006. On the 5th November, 2002, Florida’s voters banned the use of the gestation stall as a viable system for the sow, although this only affected two pork producers in the state, it set a legal precedence. In 2006, Proposition 204 was introduced onto the ballot by an Arizona Coalition which included The Arizona Humane Society, Animal Defense League of Arizona, AzSPCA, ASPCA, Farm Sanctuary and the Humane Society of the United States. This initiative included the banning of the gestation stall for the sow and also banned veal stalls. On November 7th 2006, the ballot passed, affecting an estimated 16,000 gestating sows. These laws will take effect at the end of 2012 but two exceptions to this ruling are that, stalls can still be used for (1) veterinary care, and (2) for farrowing and lactation. Recently, the humane coalition has announced that it plans to introduce similar legislation into Colorado (January, 2007).

In order for the legislative initiatives to continue and remain effective, HSUS retains the services of eight full-time lawyers, as well as numerous law clerks, administrative staff, outside counsel, and pro-bono attorneys. This section is the largest in-house animal protection litigation department in the country. The Animal Protection Litigation Section conducts precedent-setting legal campaigns on behalf of animals in state and federal courts around the country. Jonathan Lovvorn, HSUS vice president of animal protection litigation and co-teacher of an animal law

seminar at George Washington Law School has noted that “*The Animal Law Litigation Project represents an unprecedented alliance between a humane organization and one of our nation's leading law schools to move animal law out of the classroom and into the nation's courtrooms.*”

Finally, the National Pork Producers Council (NPPC) is keeping a close eye on the content for the 2007 Farm Bill. If successful the HR 5557 bill would set requirements for those producers that sell pork to the government for military, school, and other federal food programs. One of the requirements is that the animal must have enough space to completely turn around, thus preventing pork coming from sows that are housed in the gestation and farrowing stall.

5. Farrowing and lactation systems

Pig production enterprises may keep their farrowing and lactating gilts and sows outdoors, or in indoor housing systems which vary from being relatively extensive to very intensive in nature (SVC, 1997). The system a producer often options to use can be based on variety on different philosophies and decisions, for example; economics, systems already in place, systems that they have training / experience in, environmental impacts or ethical beliefs.

5.1. Welfare challenges for the farrowing / lactating sow and her litter

Farrowing stalls have become widely accepted for numerous reasons: it has made sow management easier, it allows for a higher stocking density of sows/unit of land and it can help to reduce piglet mortality (Fraser and Broom 1997). However, the farrowing stall has received criticism due to potential detrimental effects it may inflict on the well-being of the sow. The prevalence of decubital ulcers (Davies et al. 1996; Rountree et al. 1997), behaviors considered maladaptive (Cronin and Wiepkema 1984; Rushen 1984; Haskell et al. 1996), and a limitation on allowing the sow complete postural adjustments are a few considerations (Marchant and Johnson, 2007).

The assessment of overall welfare within farrowing systems presents a unique challenge for pork producers, veterinarians and animal scientists. Welfare assessment within all other phases of swine production, involves pigs at a single stage of their productive life. Within the farrowing environment, the sow and her piglets are at two very different stages of their life and have different requirements in regards to their thermal, social and physical environments (Marchant and Johnson, 2007). In addition the skills, competency, experience and dedication of the caretaker working daily with the sow and her piglet's (McGlone and Johnson, 2003) must be factored in, designing a welfare-friendly farrowing system with disregard for the person who has to care for the pigs within that system can result in the pigs' welfare being good in theory but bad in practice (Marchant and Johnson, 2007).

There are a wide variety of options available for housing the farrowing and lactating sow, ranging from housing in conventional stalls; through to housing in outdoor paddocks, some of these possibilities will now be discussed.

5.2. Standard farrowing stalls

The standard farrowing stall is usually a metal construction fixed within a pen of about 8 ft (2.5m) by 6 ft (1.8 m) with recommended dimensions of around 7 ft. (2.2 m) long and 2 ft (0.6 m) wide and 3.3 ft (1 m) high. There are a wide variety of designs, but most have common features in that they have a built-in feed trough with a water supply for the sow and her piglets at the front, metalwork running horizontally the whole length of the stall with some bars running across the width over the front two-thirds to prevent the sow from escaping by climbing

upwards. The rear usually has a removable frame, the position of which is adjustable depending on the length of the sow. Flooring may be solid concrete, with some slatting at the rear of the stall, or fully-slatted. Over the years a variety of floor types are available to the producer, bare woven wire, metal, plastic coated metal and plastic (Stanislaw & Muehling 2002). Solid flooring can be augmented with bedding, such as straw, sawdust or shredded paper. Slatted floors greatly reduce the labor required to remove manure and provide drainage for urine and soiled drinking water (Marchant and Johnson, 2007). There is usually a creep area set to the side or front of the stall which provides a warm lying area for the litter, with the heat source either from a heated mat or an overhead heat lamp.

5.3. Stall variations

i. Turn around stalls

Designs of note in this category include ellipsoid farrowing stalls (Lou and Hurnik, 1994) and triangular farrowing stalls (McGlone and Blecha, 1987). These systems also attempt to take up only the amount of overall space used by a conventional stall with pen; the above designs utilize an overall pen size of 6.6 ft (2.0 m) by 5.8 ft. (1.75 m; ellipsoid) and 8.6 ft. (2.6 m) by 4.9 ft (1.5 m; triangular). Turn-around systems are similar to conventional stalls, in that they are made out of tubular metal and the system incorporates a piglet creep area. The systems would usually be installed on a fully-slatted floor as maintaining hygiene would be difficult if used on a solid floor with bedding, due to accessibility problems for cleaning given that the sow can potentially eliminate at both ends of the stall (Marchant and Johnson, 2007).

ii. Hinged stalls

Another design that has become increasingly popular over the last few years within Europe is a system that is essentially a compromise between a conventional stall and an open pen. As much of the piglet mortality due to crushing occurs in the first few days after parturition, systems have been developed in which the sow is stalled around farrowing, but the stall can then be hinged open, usually at about 5 to 7 days after farrowing, to allow the sow space to turn around for the remainder of lactation. However, the stockperson still has the ability to restrain the sow if necessary for his or her own safety when carrying out routine husbandry tasks. As with turn-around stalls, these systems also attempt to take up only the amount of overall space used by a conventional stall with pen. The systems incorporate a piglet creep area and can be installed with solid floors and bedding or on a fully-slatted floor (Marchant and Johnson, 2007).

iii. Sloped stalls

Modifications to the slope of the stall floor have been implemented in an experimental setting. McGlone and Morrow-Tesch (1990) compared level flooring in a standard farrowing stall with an 8% slope. Bonnette (1985), sloped stalls at 14% and Collins (1987) sloped their flooring at 17%.

5.4. Indoor grouping

i. Communal pens

Many of the pens incorporate the types of features seen in the development of single open pens, but with the addition of barriers to contain piglets within the pen, yet allow the sow to

come and go from communal areas. Group sizes are usually between 4-8 sows and the system usually combines individual farrowing areas with communal lying, feeding and dunging areas for the sow (Marchant and Johnson, 2007).

ii. Swedish style multisuckling pens

There are two main types of multi-suckling management systems, which are in commercial use in Scandinavia but are also being tried as a specialist system in other countries including the USA. The first type is the Ljungström system, which involves farrowing sows in individual open pens, and keeping sows and litters individually until around 14 to 1 days of age. Then several sows, usually 6 to , and their litters are moved together into a large straw-bedded multi-suckling pen and kept here up to weaning at 5 to 6 weeks post-farrowing, when the sows are then moved out to the service area, leaving the piglets behind as a group usually until they reach a weight of 25 kg+.

The second type of system is called the Thorstensson system. This system also utilizes a large multi-suckling room, but in this instance, the sows are already grouped before farrowing. Temporary farrowing pens are placed down each long side of the room on the day the sows enter the system. These pens allow the sow to come and go, but a barrier prevents the piglets from leaving the pen before they are about 7 to 10 days old (Marchant and Johnson, 2007).

Before farrowing, the only straw in the system is within the pens, in order to encourage the sows to farrow inside, but once all sows have farrowed straw is placed throughout the room. The pens contain no heated creep area and no protection rails, placing the emphasis for piglet survival largely on the maternal qualities of the sow. Once piglet escape has become commonplace, all of the partitions are removed and the system becomes a single large multi-suckling pen. As with the Ljungström system, at weaning, only the sows are removed and the piglets remain in place for a few more weeks (Marchant and Johnson, 2007).

5.5. Outdoor arks

Several farrowing hut designs are available to the swine producer: plywood and plastic A-frames, steel English style arks and plastic and plywood models. Each hut differs in shape, for example the A frame is taller and shaped in a triangle. The 'A' frame arks are usually constructed of plywood or tin over a wooden frame, with sloping sides and a flat roof. Dimensions are about 6.9 ft. (2.1 m) wide by 6.9 ft. (2.1m) long by 3.3 ft. (1.1 m) high, in comparison to the English style hut which is lower and forms an arc (Penner *et al.* 1996; Honeyman *et al.* 1998a). Dimensions are usually about 8.3 ft. (2.5 m) wide by 5.6 ft. (1.7 m long) by 3.3 ft. (1.1 m) high. For all types, some versions have a solid plywood floor, others have no floor. In both cases, it is usual to use fairly large amounts of straw as bedding (Johnson and McGlone, 2003; Marchant and Johnson, 2007).

There is no heated creep area and no water supply for either sow or her litter. Some arks do incorporate rails to help prevent piglet crushing and some may have double skins with insulation, in order to try to reduce extremes of temperature, although research is lacking on the benefits of insulation (Edwards and Furniss 1988; Johnson and McGlone, 2003). Some producers have each farrowing ark in its own paddock, some put perhaps up to eight arks per paddock (0.4 hectare or one acre). McCulloch (1997) designed an innovative new system called the revolving paddock system, with the aim to simplify both management and movement of sows. The paddocks are laid out radiating from a central circular area (0.4 ha / slice), totaling 12 acres (4.8 hectare) with a one-strand electric fence. The central area or hub serves to handle and move

sows. The system features weekly farrowing and piglets are weaned at an average of 21 days. Sows and their litters are given a shelter with bedding and have access to a wallow. Huts are turned, dried and reused within 3 days of one litter weaned and another sow entering. Although disease occurrence is low, predation must be controlled through traps.

Many of the outdoor arks will affix a fender near the door. Fenders are partitions (1) serve to keep the piglets close to the farrowing hut, (2) keep the straw in the huts for longer, and (3) allow unrestricted movement of the sow. Fenders have been redesigned over recent years. Two fender designs that are currently used commercially are a low wooden fender that fixes underneath the front of the farrowing hut doorway, to a taller metal design. The fender entrance with the taller metal fenders can have two or three boards that slide into the front or polyvinyl chloride (PVC) rollers. Front entry heights can be altered depending on the age of the sow. Rollers have been implemented with the idea that it will prevent the sow from damaging her udder upon entering or leaving the fender area (Honeyman *et al.* 1998b; Johnson and McGlone, 2003).

6. Welfare comparisons between different farrowing / lactation systems for the sow and her litter

i. Behavior: modification of the stall

Researchers have studied the behaviors performed by the unconfined sow and have used this knowledge to implement additional “tools” into redesigning the stall to enhance sow welfare without compromising performance. Jensen (1986) concluded that feral sows, when choosing a suitable nesting site, preferred: (1) to use a variety of substrates for nest construction, (2) that the nest walls were structurally sound with well-formed sides, and (3) for the ground to slope. Fraser (1975) provided straw to the standard indoor farrowing stall and reported that sows with straw laid down more than for those that were barren (42.7 ± 3.2 versus 36 ± 5 min). Sows without straw additionally spent more time licking (15.9 ± 2.3 versus 3.5 ± 0.9 min) and biting (8 ± 2.2 versus 3.2 ± 0.9 min) the floor, trough, chains or neighboring sows compared to those that had been provided substrate.

Other studies have used hessian bags (Cronin and van Amerongen, 1991) with sows performing more nesting behaviors (13.5 ± 3.39 versus 5.2 ± 2.25 min) before farrowing and were more responsive to the distress vocalizations of their piglets (9.8 ± 2.09 versus 0.9 ± 0.48 min) than for those in the traditional stalls. Widowski and Curtis (1990) hung tassels over the stalls and reported that tassel pulling increased during the last 12h before delivery (207.4 ± 29.5 min) and this temporal pattern was similar to that of nest building by sows in pens given straw (236.7 ± 34.6 min). Phillips *et. al.*, (1991) reported that younger sows showed a clear preference for solid sided farrowing stalls compared to open sided stalls (77.8 % versus 22.2 % of total time resting).

ii. Performance: modification of the stall

Richard and Poirrier (1997) incorporated creep bars to provide piglets a safe area away from the sow and reported that sows which used the bars laid down slower (25.1 versus 14.3 seconds) and had a lower mortality rate (7.1 versus 8.3 %) at 48 h *post partum*. However, Yeske *et. al.*, (1994) did not find any benefits for pre-weaning mortality for sows that had guardrails (15.7 %) compared to those sows that did not (15.9 %). Curtis *et al.*, (1989) studied two widths between horizontal pipes in farrowing stalls: narrow (55 cm) or wide (64 cm). Sows housed with

the wider bars had a higher number of stillborns (0.5 piglets/litter) and mortality (2.0 versus 1.6 piglets/litter) compared to sows in the narrower bar stalls, 0.3 piglets/litter stillborns and 1.6 piglets/litter mortality.

McGlone and Morrow-Tesch (1990) compared level flooring in a standard farrowing stall with an 8 % slope and found that more piglets were crushed (1.3 versus 0.5 ± 0.51 piglets/litter) and fewer piglets were weaned (7.6 versus 8.2 ± 0.38 piglets/litter) when stalls sloped. Bonnette (1985) sloped stalls at 14 % and although there were no differences compared to level floor stalls, number of live born piglets was favored for sows that farrowed in the sloped stalls (10.7 versus 9.8 ± 0.41 piglets born alive/litter) but for all other performance variables there were no differences. Collins (1987) agreed with Bonnette's findings when sloping the floor to 17 % that there were no differences in sow or litter performance.

Van Veen et. al., (1985) looked at performance of sows provided with straw and concluded that pre-weaning mortality decreased for those provided with the straw (0.4 piglets/litter) compared to sows with slatted flooring in stalls (1.2 piglets/litter). However, Edwards and Furniss (1988) and Cronin and Smith (1992) have indicated that adding straw to the stall did not decrease piglet mortality.

iii. Indoor vs. outdoor performance comparisons

Several reports have compared the performance of both the intensive indoor versus outdoor farrowing systems but some information is conflicting. Bowman and Ott (1993) summarized 1,661 farms within the US categorizing the farrowing facilities into three categories: total confinement (farrowing stalls), huts and open buildings. Age of weaning was lower in total confinement (30.2 d) than in open buildings (39.2 d) and huts (35.4 d) and more piglets died in huts and open buildings (13 versus 9.7 %) compared to total confinement (6.7 %). The authors concluded that sows kept in huts could be as productive as those kept in total confinement but the production in open barns was not as economically competitive.

Berger et al., (1997) studied 76,578 litters born outdoors on pasture and 867,719 litters born indoors in farrowing stalls. Fertility measured as interval between farrowing (days) was better indoors than outdoors (152.9 ± 9.2 versus 155.3 ± 9.2); however, the number of piglets born was the same (11.7 ± 1.1 number of piglets born/litter). Piglet mortality was higher in the outdoor (21.1 %) than in the indoor system (17.4%), which affected the average number of piglets weaned/sow/yr (21.6 ± 2.2 versus 25.1 ± 2.2 piglets weaned/litter). Seasonal effects (with higher mortality occurring late autumn and early winter) and a parity effect (with a decrease in piglet mortality from parities one to two and then successive increases) were also reported. Mortensen et al., (1994), van der Steen (1994), and Le Denmat et al., (1997) have all reported that a well managed outdoor unit can be as competitive as a well managed indoor unit for performance.

McGlone and Hicks (2000) compared performance of outdoor-housed sows in the American and English style-farrowing huts. Sows in the English style-farrowing huts weaned more piglets (10 piglets/litter) compared to the American huts (8.5 piglets/litter). Penner et al. (1996) looked at seven different commercial floorless farrowing huts in regard to pre-weaning mortality and reported that the plywood A-frame had the highest pre-weaning mortality at 22.4 %. This number decreased depending on the type of hut: plastic A-frame, 15.7 %, Quonset curved steel, 11.7 %, plastic pig saver, 10.8 %, modified plywood A-frame, 7.6 %, steel English style, 6.3 % and plywood pig saver, 6.0 %. The number of live born piglets/litter ranged from 7.4 to 9.8 but other deaths did not differ by hut type. A frame (wood), pig saver (plastic), Quonset (curved steel) and A frame (plastic) were designated as smaller huts (3.24 to 3.37m^2) and had

piglet crushing losses of 11 to 22 %. English style (steel) modified A-frame and pig saver (plywood) had 4.54 ft². (3.78 m²) to 5.35 ft.² (4.46m²) and crushings were reduced by 8 %. The English style hut and modified A-frame, apart from having more space also positioned the door at the front side not the center and pig saver (plywood) had guard rails (Honeyman et al. 1998a). Johnson et. al., (2001) compared sows that farrowed in stalls versus those that farrowed in English style farrowing huts. Although behavioral differences were noted for both the sow and her litter (Table One), the performance measures collected did not differ between groups.

Table One: Behavioral differences for sows and their litters when housed in farrowing stalls vs. farrowing huts (Johnson et al., 2001).

Behavior	Environment		SE	P-value
	Indoor	Outdoor		
No. sows	20	20	.	.
Active, %	9.1	27.9	2.7	< 0.001
Lying, %	90.9	72.1	2.7	< 0.001
Drinking, %	4.42	1.4	0.6	0.004
Nursing Int., min	40.1	42.2	2.4	0.30
No. litters	20	20	.	.
Walking, %	5.2	10.1	1.7	0.02
Nursing, %	20.3	27.5	2.0	0.03
Playing, %	1.7	5.0	1.2	0.046

8. Conclusions

The debate over the gestation stall and what system is “humane” will continue to challenge the US pork industry for many more years. The humane groups have had success through the legislative route, and have made another attempt for Colorado in 2007. Such initiatives will dictate to those affected producers what gestation systems are tolerable to the general public. Pork associations from states that have yet to be challenged through a legislative initiative are strongly encouraged to consider a counteractive plan, so that when such attempts land at their door they have the personnel, ideologies and course of action clearly ready to implement.

The farrowing stall has many benefits for the piglets’ welfare, and to date, farrowing and lactation systems have not been challenged on welfare grounds in the US (either through public debate or through the courts). However, the industry must anticipate that challenges may arise against the farrowing stall; for example, groups may demand that the sow is only confined for the first 72 hours after farrowing or to encourage the use and availability of substrates for nest building prior to farrowing. It should be emphasized that upon reviewing the scientific literature available on the farrowing / lactating sow and her litter that **all available options** have positives and challenges (Table Two).

Therefore, it is critical for the US pork industry to continue their Checkoff funding into areas explores different methods of management and housing for the sow and her litter and to provide sound science back to the industry to help create new welfare programs and tools for the US pork producer.

Table Two: Challenges and benefits between stalls and indoor / outdoor farrowing systems for the sow and her piglet.

Stall	Other systems
Pre farrowing	
Most commercial and experimental farrowing systems do not allow the sow to seek and achieve isolation.	Sows may select a farrowing site that is inappropriate i.e. within communal area or dunging area.
Sows are highly motivated to build nests and put a lot of energy into finding suitable nesting site.	
Movement / “freedom”	
Conventional stalls do not allow freedom of movement and sows are highly motivated to cover large distances seeking a nest site during this stage of the process.	Still an element of restriction of choice and space in alternatives.
May affect longevity of the sow; being researched currently.	Changing posture may make access to the udder more difficult and may place piglets in danger.
	Open systems can make savaging easier.
	Nest abandonment; if piglets can not follow their mothers stave out can be a problem.
Facilities / Environment	
Many current systems are geared up for liquid manure handling. Most alternatives are geared up for bedding.	Hard to control weather extremes / mud.
Safety / pigs and people	
Stalls offer more people protection against a protective sow.	Open systems may make intervention more difficult.
	Piglet predation increases in outdoor systems.

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