

### *Swedish deep-bedded group nursing systems for feeder pig production*

#### **Overview**

On many farms, outdoor swine production (see ISU Extension publication SA-9, February 1996) is not possible. For producers who favor systems that are less mechanistic than intensive confinement, but who still want their swine operation indoors, Swedish deep-bedded group nursing systems may offer an attractive option. This second installment in the Swine System Options series looks at these “extensive” methods of confinement, focusing on the model popularly known in Sweden as the Västgötamodellen. Because U.S. experience with these systems is limited, this fact sheet describes Swedish practices. Although most practices should transfer well, some fine-tuning to U.S. conditions (e.g., climate, available feeds, and disease patterns) may be advisable for U.S. adopters.

#### **Background of the Model**

Deep-bedded group nursing and weaning systems evolved in Sweden in part because farmers needed more natural, stress-free weaning methods to comply with restrictions banning subtherapeutic antibiotic use in animal feeds. All-in/all-out, planned production; longer nursing periods; and behaviorally appropriate management and design improve herd health and contribute to a high level of individual pig welfare. These yield high conception, farrowing, and growth rates. But the systems also demand top-notch, proactive management; careful attention to detail; and a “preventive” approach to maintaining animal health.

#### **Västgötamodellen’s Features in Brief**

##### **Management**

Two principal versions, named for the farmers who designed them are: (1) farrowing in individual pens in farrowing room and transfer of sows and litters to a group nursing room when pigs are 14 to 20 days old (Ljunström version); and (2) farrowing in temporary, wooden boxes in group room with removal of boxes when pigs are seven to 10 days old (Thorstensson version).

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- Planned production; sow herd divided into stable subgroups of eight to 12 sows (smaller subgroups are better); 23-week reproductive cycle; natural and artificial insemination (AI).
- Weaning initiated by sows and completed by removing sows and returning them to mating when pigs are five to six weeks old.
- Growth of pigs to 55 to 60 pounds in nursing rooms; finishing in separate facility.
- Loose housing in all phases for Thorstensson and in all but farrowing for Ljunström version.
- All-in/all-out farrowing, nursing, and growing.
- Ad libitum (ad lib) feeding for sows and litters in lactation; once or twice a day feeding in gestation and breeding (about half the farms feed twice a day); water ad lib in all phases.
- No subtherapeutic antibiotics or other growth promotants in the feed.

Fewer farms use the Thorstensson version than the Ljunström version. A recent variation not covered here is to keep sows and litters together in Ljunström-type farrowing pens until weaning when sows are returned to mating and litters are moved to deep-bedded growing rooms.

### **Facilities and equipment**

Well-insulated and ventilated buildings for pigs and worker comfort; layouts designed for easy movement of pigs between rooms.

- Minimum 11-foot high ceilings; concrete floors with floor drains under the waterers.
- Two bowls or two nipple waterers recommended for sows; two bowls or four nipple waterers recommended for small pigs.
- Four-foot-wide alleys for feeding, walking from room to room, and moving pigs.
- Natural lighting supplemented by artificial lighting.
- Space requirement for boars; 64 to 74 square feet per individual (higher figure if no separate dunging area is provided).
- Space requirements for sow and litter in pens (Ljunström) and boxes (Thorstensson):
  - pens with manure gutter—54 sq. ft. exclusive of gutter
  - pens without manure gutter—64 sq. ft.
  - boxes—48 sq. ft. (6x8) are used, but 64 or more sq. ft. are better; doorways cut into front to fit dimensions of entering sow, and with 16-in. thresholds, including a roller top, to contain newborn pigs
- Minimum space requirements in group rooms (exclusive of feeding area):
  - gestation and mating—27 sq. ft. per sow
  - lactation—81 sq. ft. per sow and litter
- Individual sow feeding stalls in gestation and mating, 20 to 22 inches wide by 7 feet long on concrete platform 16 inches higher than floor of bedded area, to allow for buildup of bed.
- Five- to 6-foot-wide feeding platform, 12 inches higher than floor of bedded area, located along width of farrowing/nursing rooms, with pig creep area sectioned off.

### **Manure handling**

Large outdoor doors to each group room; skid steer loader removes soiled bedding. Solid handling in farrow-to-feeder farms. Both liquid and solid in farrow-to-finish farms. Ten-month, outdoor storage on concrete platforms for soiled bedding; concrete “tanks” for liquid manure set in ground below frost level but above groundwater level. Liquid manure storage required to be covered; straw crust qualifies as cover. Manure incorporated within 24 hours of spreading.

## Genetics

Swedish Landrace-Yorkshire sows (which have good mothering abilities) bred to terminal Hampshire boars (which are lean) produce high-quality market hogs (60 percent average lean carcass). Some culling after second parity to select for good mothers, if necessary.

## Veterinary needs (common to most Swedish farms)

All medicating by Swedish producers surveyed is done under veterinary supervision; medicines available only with veterinary prescription. Sows vaccinated for parvo and erysipelas; ivermectin used to control parasites and worms. Pigs processed at three to four days old and receive iron injections only. Castration but no tail docking allowed. Most farmers file (rather than clip) needle teeth with a portable electric grinder.

## Feed (common to most Swedish farms)

Small grains with supplements; typical dry mix of wheat, oats, and barley, plus soybean meal or other protein source with vitamins and minerals. Liquid feed mixed on many farms; fresh whey forming 65 to 75 percent of mix.

## Straw

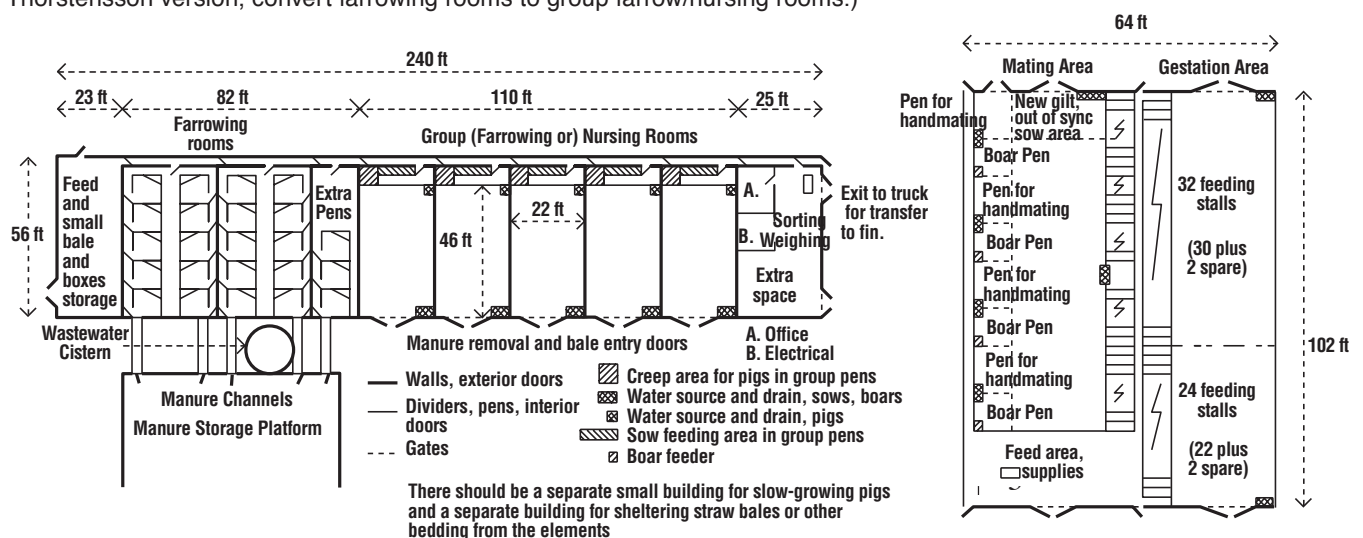
Between 1.7 to 2.2 tons/sow/year. Correspond to around five or six 750-pound round bales/sow/year. Wheat and barley straw are preferred over oats due to superior absorbency; straw preferred to shavings or sawdust for the same reason.

## Labor/management

Averages about 18 hours/sow/year for farms that keep labor records. Lower than conventional systems for repairs, cleaning, moving, medicating, assistance at farrowing, etc.; higher for observation, management, and planning.

## Facility Design and Management

Figure 1. Example layout, Ljungström system. Farrowing every two weeks, 110 sows, 4 boars, 11 groups, 10 sows per group, 5-week weaning. When farrowing every 3 weeks, with 6-week weaning, use 5 rather than 7 farrow/nursery rooms. (For Thorstensson version, convert farrowing rooms to group farrow/nursery rooms.)



**Mating Center.**



*Sows in a subgroup must conceive and bear litters within a few days of each other.*

### **Mating, insemination, and conception**

Sows in a subgroup must conceive and bear litters within a few days of each other. In a group room, more than five days' difference in ages between youngest and oldest pigs can lead to starvation, increased injuries, and mortality among the youngest pigs. Hence, mating is the most critical stage. Ad lib feed during lactation and freedom to control nursing help sows maintain condition. Sows are ready for mating naturally within a few days of returning to breeding from group nursing rooms. The excitement of the move and nose-to-nose contact with boars in adjacent pens speed onset of estrus. A combination of handmating and AI is used. One boar can mate a maximum of two times a day for four days. This breeding regimen in conception rates above 90 percent and high average litter sizes.

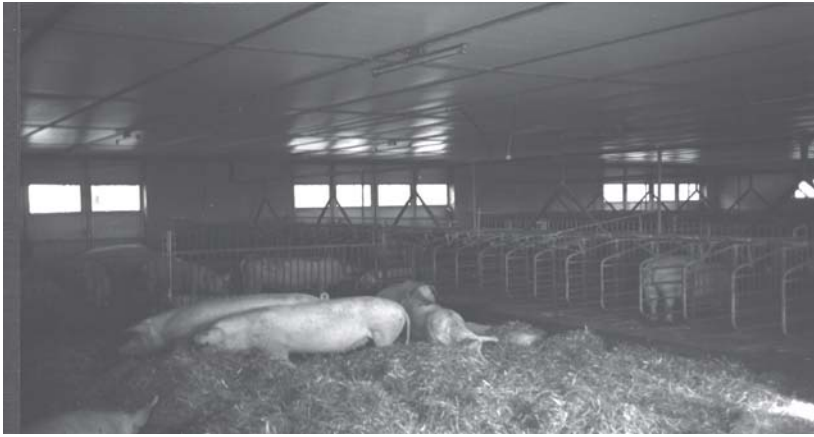
Egg implantation occurs from 10 to 28 days after conception. Newly mated sow groups can join other pregnant sows in the gestation area directly after mating. Any fighting will take place within the first two days of the new group's introduction, before implantation begins. However, some farmers prefer to have pens adjacent to the mating areas where newly mated subgroups can be held for observation for four weeks following mating. Sows returning to heat can be detected easily; others are moved to the gestation area when pregnancies have been established.

### **Gestation**

Several sow subgroups are in the dry sow area at the same time. How many will depend on how many subgroups are in the herd and how many weeks there are between breedings. Each member of a subgroup is similarly marked or tagged. Each subgroup spends about 12 weeks in this area.

*Individual feeding stalls in mating and gestation ensure that sows get enough feed.*

Individual feeding stalls in mating and gestation ensure that sows get enough feed. Stalls can be locked from behind while sows are eating, preventing aggressive sows from claiming a neighbor's feed. While sows are eating, is a convenient time to clean or add bedding. Stalls can be used as a place to treat individual sows. The front of each stall opens individually onto the feeding alley. When a subgroup of sows is ready to farrow, this makes it easy to move the subgroup to the farrowing area.



**Gestation/dry sow area.**

A single female introduced alone to an established dry sow group may be injured. New gilts or out-of-sync sows are added to an established dry sow group only if they already form a stable subgroup of at least three, but preferably five to six, sows and/or gilts. The established group appears to have more “respect” for sows entering as part of a group. This is the only way to introduce gilts or out-of-sync sows in the Thorstensson system.

Space and abundant straw for comfort and occupation help maintain peaceful relations among sows. A minimum meeting distance of 6.5 feet between adult hogs permits lower ranking animals to show their submissiveness by turning aside, thus avoiding a fight. The right mix of straw, manure, urine, and air in the beds also starts and sustains the composting. (It is important never to let the straw bed become wet.)

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### **Farrowing**

In the Ljunström version, sows farrow in a farrowing room in conventional Swedish farrowing pens and are moved with their litters to deep-bedded, group nursing rooms when litters are 14 to 20 days old.

Farmers using the Ljunström system can take advantage of this move to introduce gilts or return out-of-sync sows to a group. Farmers first move gilts and their litters to the nursing room and allow them to get acclimated. Then, they bring in out-of-sync sows and small sows from the established group together with their litters. Finally, old sows in the group are added with their litters. This “move” can take an entire day. Occupied with their litters and the new situation, sows do not seem interested in fighting.

In the Thorstensson system, a few days before a group is due to farrow, the farmer begins to prepare the group room. First, wooden farrowing boxes are assembled and fastened to the room walls. Then the boxes are deeply bedded (at least eight inches deep) with loose straw. Sows are brought into the room one to two days prior to farrowing.

As farrowing nears, each sow selects a box and begins to build a nest. A favorable layout of the room, with nest boxes along the sides and light bedding in the area outside the boxes, discourages sows from farrowing outside the boxes. However, if farmers notice that a sow appears to be

**Typical Swedish  
farrowing pen  
(Ljungström  
system).**



starting a nest outside, they herd the sow to a box and lock her in until she has farrowed. If farrowing already has begun outside, farmers let her continue and, when all pigs have been born, carry them to an empty box. The sow follows and accepts the box as her nest.

Prior to entering her box, a good mother emits loud grunts to warn her pigs of her presence. She then climbs slowly into the box, using her snout to make a furrow in the straw and push pigs aside before she lies down.

Boxes are removed and sows and litters are allowed to mingle when pigs are seven to 10 days old and strong enough to climb over the rollers to follow their mothers.

### **Lactation**

During the first days alone in the farrowing pen or box with their mother, pigs become familiar with her smell and voice, and bonding occurs. Pigs also establish a “teat order” that they stick to throughout the nursing period. Later, when they are in a group with other sows and litters, they can locate their mother easily when she begins calling them to nurse. Since milk letdown lasts only 20 seconds, pigs need to be able to distinguish their mother’s call from those of others in the group and reach her quickly. Therefore, extraneous noise levels must be kept low, under 45□decibels. Special ventilation systems, capable of moving large volumes of air at low speeds, help keep the rooms quiet and animals comfortable.

**Thorstensson  
farrowing box.**



Feed and water are provided ad lib. The feeding area runs along the front of the room. A creep area is sectioned off for pigs. Water supply is sized for pigs and sows. Sow and pig waterers should be some distance from each other; otherwise some sows, who like to lie where it is cool, will block the pigs from their waterers.

### **Weaning and growing**

Gradually, nursings shift from being initiated by sows to pigs taking more initiative. As pigs grow, sows instinctively begin restricting the number of nursings to preserve their own fitness. The Swedish animal welfare act requires that pigs not be weaned before four weeks of age, but Swedish farmers prefer weaning at five to six weeks to coincide with sow reproductive cycles. This also gives pigs a chance to learn to eat by their mothers' sides, become accustomed to solid food, and develop their natural immune system. Weaning is accomplished by removing sows from the rooms. Their smells remain, reducing the stress of weaning. Farmers place fresh straw over the tops of the bed before weaning to protect pigs from coming into contact with harmful bacteria when they sniff the bed looking for their mothers. Pigs remain in the room until they are 11 to 12 weeks of age, or 55 to 60 pounds. Then, they are transferred to the farm's finishing operation or sold to a finisher.

### **Cleaning, straw-bed management, and manure handling**

Because pigs eat the straw, it must be stored indoors to ensure that it is of good quality and does not contain mold or toxins that can cause abortions, stillbirths, or lowered immunity levels.

In the gestation rooms, beds are allowed to build up and are cleaned out with a skid steer loader three to four times a year. The mating areas become dirty sooner and are cleaned out more often. If a farm has a separate farrowing room, soiled pens are cleaned and pressure-washed every time a sow group with litters leaves to go to group nursing. Group nursing rooms are cleaned out and pressure-washed after the growers leave and before a new group enters.

Two critical factors affect performance of deep-straw beds: the carbon/nitrogen (c/n) ratio in the soiled bedding and moisture content of the beds. Ammonia emission is a function of the carbon/nitrogen ratio of animal manures. In the deep-straw beds of Swedish swine housing systems, the right amount of straw and correct management can prevent ammonia (and corresponding odor) emissions.

A minimum c/n ratio of 30:1 is required to prevent ammonia emission. As the ratio falls from this level, ammonia increases. Adding straw to manure already in a room raises the c/n ratio slowly, but it takes a long time and a great deal of straw. Meanwhile, ammonia is being given off. For a room with 8 to 10 sows, Swedish farmers begin with two 750-pound, round bales of straw in the room before animals enter. Starting with an extremely high c/n ratio (60:1 or 70:1), allows carbon to capture nitrogen in the urine and manure. Thereafter, farmers manage the beds closely, adding a 750-pound

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**Group nursing room.**



*Cut (rather than chopped) straw gives a buoyancy to the beds that allows air to enter and begin the composting process.*

bale each week and placing fresh straw over wet spots daily to keep bed surfaces clean and dry. Peat can be used beneath the straw to help absorb moisture.

Moisture content of the bed should be somewhere between 40 and 60 percent to start and sustain composting. Cut (rather than chopped) straw gives a buoyancy to the beds that allows air to enter and begin the composting process. Composting destroys any pathogens or parasites present in the manure. When moisture content is below 40 percent and the c/n ratios are above 35:1, the bed will still compost, but more slowly. But if the moisture content of the beds is above 60 percent, beds become malodorous, cold, and wet. A cold, wet, anaerobic bed is bad for health and growth rates. It can lead to discontented or agitated sows that can, in turn, cause pig crushing and starvation.

If insufficient straw is used, and the bed become anaerobic, there is no way to restore aerobic conditions. One must either clean the room out and start over right away or, if beds have been allowed to become anaerobic in one of the group nursing rooms, farmers must wait until they have moved the current group of pigs and try again with the next group.

Wastewater drains from bedded pens into cisterns and is either spread separately with manure tanks or periodically pumped over stacked, soiled bedding and spread with the solids. Composting that begins in the rooms continues in the outside storage. Stillborns and crushed pigs are disposed of deep in the compost.



## Ventilation

A properly functioning ventilation system is critical in deep-bedded housing. While temperature and air speeds are somewhat less critical for housing adult hogs, Swedish farmers use insulated, draft-free, and quiet but well-ventilated rooms for group farrowing and nursing. Minimum ventilation rate should be regulated according to relative humidity in the room. The recommendations for ventilation rates are:

- 25 cfm, plus, per sow/litter for the minimum or continuous rate (to maintain relative humidity between 70 and 80 percent)
- +60 cfm per sow/litter for the mild weather (fall/spring) rate
- +400 cfm per sow/litter for the “summer” rate
- +450 cfm for every 10 weaned pigs to 55 pounds

Composting beds give off heat, moisture, and carbon dioxide. It is important to move a large volume of air efficiently, particularly in summer, but at low air speeds and noise levels. Hence it is important to have a sufficient number of air inlets in each room with efficient air outtake.

Drafts or pockets of chilly air in the room, too high or low room temperatures, or too much humidity in the atmosphere interferes with normal pig behaviors and foster illness and discontent. Sows may cluster in non-drafty parts of the room. Pigs may not want to leave the warm beds when their mothers enter the boxes to nurse. Both situations can increase pig injuries and mortality. If the atmosphere is “satisfactory,” sows will be positioned evenly throughout the room.

A common mechanical ventilation method used in Sweden is to have the entire ceiling serve as the air intake. The “breathing” ceiling consists of a porous, woven plastic canvas, supported by slats on the underside with a three- to four-inch layer of insulating material on the side facing the attic. An outtake vent in each room is connected to a “chimney” or air duct running to the roof through the attic. Outtake fans are located far up in the chimneys, close to the roof, keeping noise in the rooms at acceptable levels. Outside air brought into the attic from vents under the eaves is warmed by the insulating material as it is drawn down into the room by the outtake fans.

## Animal management

Swedish farmers using deep-bedded group nursing systems say they “fit the system to the animal rather than the animal to the system.” Assuring optimal performance from pigs in extensive confinement requires organization, excellent stockmanship, and an appreciation of pig behaviors and of the individuals in one’s own herd. Swedish farmers say one needs “the farmer’s eye” or to see things “through the eyes of pigs.” These systems work best for farmers who are proactive managers, pay close attention to details, enjoy working with pigs, and like to see good results from contented animals in a clean, well-kept environment.

*Drafts or pockets of chilly air in the room, too high or low room temperatures, or too much humidity in the atmosphere will interfere with normal pig behaviors and contribute to illness and discontent.*

## Production

Swedish farmers keep sows to tight cycles, skipping no heats. On average, in established systems, sows are past their fifth parity before they are culled. Table 1 compares averages from herds using the Västgötamodellen group nursing system with averages from other herds in the district covered by Scan-Farmek, a regional division of the Swedish farmers' meat marketing cooperative.

**Table 1. Herd Average Comparisons: Västgötaherds and others in Scan-Farmek.**

	Västgötaherds	Other herds
Number of herds	49	296
Average number of sows and gilts	95.2	77.9
Farrowing interval, days	165.8	169.0
Days, weaning to first insemination/mating	6.7	6.8
Conception rate	91.2	87.6
Percent gilt litters	17.7	23.7
Liveborn per litter	11.0	11.0
Stillborn per litter	.7	.9
Weaned pigs per litter	9.4	9.3
Weaned pigs per sow and year	20.7	20.1
Age at 60 pounds, days	80.7	86.0

(Source: Barbro Mattsson, 1995)

## Getting Started

The Swedish deep-bedded group nursing model has been refined over a period of eight to 10 years. Swedish hog farmers also have nearly 20 years of experience with loose-housing dry sows in groups on deep-straw beds. It is recommended that a new producer rely heavily on Swedish experiences. Some modifications—for example, to accommodate climate extremes—may be needed. But other tempting adaptations may already have been tried, found wanting, and discarded by Swedish farmers.

This model is a system of interrelated parts where details count. Consistent and attentive management is critical to success. Because “preventive” maintenance is so vital, adoption requires time and patience to learn new skills and stay on top of things. We do not recommend starting without guidance from those who have experience with the system or if the hog enterprise will not have a high priority on your farm.

Use gilts that have been reared in groups in loose housing, and that have been bred for broadly defined maternal qualities (i.e., not just prolificacy or milking, but care of the young). Swedish farmers also recommend that every gilt should “get a second chance.”

It is suggested also that new adopters begin with deep-bedded group housing for gestating sows and planned production. Once they have learned to manage deep beds and mastered scheduling and managing dry sows in groups, producers might then move on to weaning pigs onto deep straw directly from farrowing pens, and from there to managing nursing sows in groups.

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Finally, do not mix intensive and extensive systems; that is, do not use farrowing crates after sows have been loosely confined in groups during gestation (use individual pens instead) and do not use boxes for farrowing after sows have been kept in crates during gestation. The transition between systems can increase sows' stress levels and, consequently, have adverse impacts on liveborn results.

## **Other Information and Sources**

### **Consultants**

Marlene Halverson  
Northfield, Minnesota  
507-645-2478 phone and fax  
e-mail: ALM\_HALVERSM@carleton.edu

Mark Honeyman  
Ames, Iowa  
515-294-4621 phone; 515-294-6210 fax  
e-mail: honeyman@iastate.edu

Dennis Kent  
Lewis, Iowa  
712-769-2402 or 712-243-2729 phone; 712-769-2459 fax

Larry Jacobson  
St. Paul, Minnesota  
612-625-8288 phone; 612-624-3005 fax  
e-mail: jacob007@maroon.tc.umn.edu

### **Producers**

Tom and Sharon Van Milligen (since 1990)  
Bridgewater, NS, Canada  
902-685-2449 phone; 902-685-3082 fax

Nolan and Susan Jungclaus (since 1995)  
Lake Lillian, MN  
320-664-4843

Dan and Lorna and Colin and Carla Wilson (since 1996)  
Paullina, Iowa  
712-448-3870; e-mail: dwilson712@aol.com

*Stalls for feeding sows individually in groups* (this entry is intended to provide information; it does not constitute an endorsement)

BSM, Ltd., Canada  
Virgil Rueck, midwestern representative  
217-388-2402 (or contact your local equipment dealer regarding access to BSM)

### Other reading

- Algers, Bo 1996. "Managing Alternative Production Systems: A Swedish Perspective." Swine System Options for Iowa. Proceedings, February 21 Conference, Leopold Center for Sustainable Agriculture, Iowa State University.
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Prepared by Marlene Halverson, project consultant; Mark Honeyman, associate professor, Animal Science Department; and Mary Adams, editor, Leopold Center for Sustainable Agriculture, Iowa State University.

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