NEW CONCEPTS IN BREEDING BARN DESIGN

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Summary

Many existing swine breeding facilities have been designed to control the environment, provide continuous boar-sow contact for stimulating recently weaned sows to cycle, reduce the distance a weaned sow or boar has to be moved for mating, and reduce construction costs by not constructing breeding pens to be used only for mating. Pork producers operating these types of facilities have had problems with efficiency and accuracy of estrous detection, low percentage (70%) of sows bred twice, slick breeding floors, and excessive labor requirements. A breeding facility should be arranged so the work routines, such as estrous detection; moving, mating, and feeding animals; and recording breeding information are easily, quickly, and safely performed. Remember, tasks that are difficult to do may never be done.

(Key Words: Facilities, Breeding, Sow.)

Planning Considerations

During the last 5 yr, I have spent a lot of time designing, evaluating and redesigning hand-mating facilities that minimize human frustration and maximize estrous expression in females (sows and gilts). The goals I always have in mind when designing or redesigning (remodeling) a hand-mating facility are shown in Table 1. The overall goal is to design an efficient breeding facility that takes into consideration both human and animal factors.

Breeding Facility Components

The five major components of a hand-mating facility that need to be correctly designed are: 1) housing area for newly weaned sows; 2) temporary housing area for bred sows or gilts after first service or heat checking when females are penned as a group; 3) housing area for replacement gilts; 4) housing area for boars, and 5) non-slick breeding pen floors. Placing each of these five components in the correct location is what makes a hand-breeding facility operate smoothly, especially during estrus detection.

Housing newly weaned sows. For efficiency in detecting estrus, the newly weaned sow area needs to be separated from the boar area, but designed so an option exists to provide or not provide close boar contact for 2 to 3 d after weaning.

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Researchers have not been able to agree on whether weaned sows should be housed in small pens (4 to 10 sows/pen) or individual stalls immediately after weaning to increase reproductive efficiency. Animals (breeds) that have trouble competing or are extremely valuable from a genetic standpoint should be housed in stalls (24 in. wide, 84 in. long, 40 in. high) or small pens holding four sows.

Small groups (4 to 10 sows/pen) of recently weaned sows are simpler to handle and manage than larger groups. When housing recently weaned sows as a group in a modified open front (MOF) or mechanically ventilated building give each sow 20 ft^2 of non-slick floor surface. The solid concrete portion of a partially slatted floor can be made non-slick by imprinting a 4- to 5-in. o.c. wide diamond pattern 1/2 in. deep in the floor. Feeding on the floor also helps keep it clean and dry.

Temporary holding pen. When weaned sows are housed in a group, a temporary holding pen is needed to keep bred and/or heat-checked sows away until all sows in the home pen have been moved through the breeding-heat checking pen. The temporary holding pen also helps prevent other sows from becoming sexually stimulated (expressing standing estrus) before entering the breeding pen.

Housing boars. The largest risk for human injury occurs when people are working around boars, especially during hand-mating. To reduce this risk, boars should be moved to and from the breeding pen in narrow (28 to 42 in.) alleys with the aid of a hand-held solid panel.

Boars should be individually housed so: 1) injuries from fighting and riding can be prevented; 2) feed intake can be adjusted to maintain proper body condition; 3) longevity of use can be increased; 4) homosexual activity is reduced; 5) sexual behavior can be optimized; 6) handling is simplified, and 7) financial costs can be reduced as a result of the need for fewer replacement boars.

Boars should never be stalled individually on solid concrete floors. A boar stall should have at least 56 in. of slats at the back. Boar stalls should be 46 in. high, 28 in. wide, and 8 ft long for large boars. Stalls to house medium-sized boars can be 40 in. × 26 in. × 7 to 8 ft. For small boars, recommended dimensions are 40 in. × 18 to 24 in. × 6 to 8 ft. Boar stalls should be constructed of vertical pipe and have an efficient gate latch.

Boars need to be maintained in an environment that maximizes their fertility, because boar fertility does influence farrowing rate and litter size. It is especially important to prevent high ambient temperature in a boar barn. Although heat stress (temperatures above 85° F) may completely inhibit sperm production in some boars and cause only slight reductions in semen quality in others, it is important to keep all boars cool. Depending on the severity of heat stress, boar fertility can be depressed for 2 to 8 wk after heat stress ceases. Boars are also less willing to mate at temperatures above 80°F.

Breeding pen. Breeding facilities should be designed so one individual can easily and quickly provide assistance to animals in four to six breeding pens. In other words, one individual is continually supervising the heat checking and/or breeding of four to six sows at one

time. The breeding pen should be used only for breeding and heat checking; therefore, a good non-slick surface can be used. Slick breeding floors contribute to animal injury, human safety hazards, and a decrease in reproductive performance.

All breeding pen partitions and gates should be 48 in. high, made of vertical pipe, and have an efficient gate latch. The gate entering the breeding pen should be easily and quickly opened, swing at either end, and cut off the alley; thus, all sows, gilts, and boars have to go into the designated breeding pen.

The breeding pen dimensions should be at least 8 ft^2 (8 × 9 is preferred). Small breeding pens and/or slick floors add to human frustration and become safety hazards. The breeding pen should be designed so that an estrous female remains in the pen while the gate is open for the boar to enter and so it provides safety to humans.

Gates and gate latches. Gates used to control animal flow through an alley should be designed to cut off the alley when open. It is also beneficial to have gate latches that function quickly and easily. Figure 1 shows a gate latch that works well for gates that need to swing at either end and does not have animals housed on both sides of it. To prevent animals from opening the gate, the first two vertical pipes next to the latch are not more than 2 in. apart. THE GATE ROD SHOULD ALWAYS BE FASTENED TO THE GATE. By using the stop feature, the rod cannot be removed from the gate. Attaching the rod to the gate allows the gate to be swung open with one hand on the gate latch, while the other hand is free to hold a hurdle for animal control. Also, a gate can be easily locked open, if the gate rod is on the gate.

Estrous Detection

The main point to remember when designing a system to detect estrus quickly and efficiently is to not allow sows or replacement gilts to receive boar stimuli (sight, sound, and smell) for 1 to 2 h before they are checked for estrus. Any type of close contact between females and boars before heat checking reduces the efficiency of finding females in estrus. Estrus is characterized by a rigid immobilization response (standing heat) and usually not maintained for more than 10 min in sows and 7 min in gilts. A female that exhibits rigid immobilization is temporarily performing "isometrics"; therefore, she will need muscle relaxation after a few minutes of muscle contraction. During the relaxation phase, it is much more difficult to detect estrus.

The first step in designing an estrus detection program is to provide an environment for close boar-sow contact during the first 2 d after weaning. This can be done by penning a boar in an adjacent pen for 24 h or for several hours in an alleyway next to weaned sows. Another effective method is to place a boar with low sexual activity in the weaned sow pen. However, some pork producers have found no benefit by having close boar-sow contact for the first 2 d after weaning. Their estrus detection efficiency was just as good, if not better, when weaned sows were not exposed to the boar. Boar contact during this time period may be of value, however, in stimulating "problem" sows to cycle on some farms.

The second step is continuous separation of sows and boars except during the time of heat checking. The exact distance required for separation varies with type of facility employed. Separation can be accomplished in some facilities by installing a wall. If a wall is not feasible, a distance of at least 30 to 50 ft should separate the boars and females to be heat checked. Gestating sows located between the boars and females to be heat checked can act as a "buffer zone" to prevent estrous sows from receiving boar stimuli. The main objective is to provide an environment that prevents weaned sows from receiving sexual stimuli from boars until the time of heat checking. Although the immobilization response in the sow is released by physical contact, it is the sight, sound, and smell of the boar that facilitate immobilization.

The actual mating process occurs when weaned sows are taken to a specific heat checking and breeding pen for estrus detection and mating. If the sows are in estrus, a rapid, strong immobilization response will be observed. The boar is not taken to the sow area because he may stimulate all estrous sows into the mating stance. If this occurs, some sows will not stand very well, if at all, when a second boar is taken to their pen 15 to 20 min later for breeding. **REMEMBER, A MORE INTENSE AND IMMEDIATE ESTROUS RESPONSE WILL OCCUR IF THE SOWS HAVE NOT HAD BOAR CONTACT FOR 1 TO 2 HOURS BEFORE HEAT DETECTION AND MATING.**

Sows should not be returned to their home pen after mating or heat checking when housed as a group until the whole pen has been through the heat check and breeding pen. This step helps prevent other estrous sows from receiving boar stimuli before entering the breeding area.

Animal Movement

Breeding facilities should be designed so one person can easily and safely move any animal (boars, sows, or gilts) without assistance. Sows and gilts that are in estrus and have not had recent boar stimuli are easily moved to a breeding pen. However, DO NOT move them past boars before they enter the breeding area, because they will most likely "lock-up" before getting to the breeding pen. Sows being moved to a breeding pen generally move at the rate of 1 ft/sec. Most sows are easily moved back to their own stall or pen after mating. Boars quickly become trained to a consistent breeding system, and most are easily moved.

Human safety hazards can be reduced when moving animals by: 1) having animal flow continuous and never dead-ended; 2) moving animals, especially boars, through narrow (28 to 42 in.) alleys, and 3) using solid, hand-held panels. It is also important to not have spilled feed in the alley when moving animals because they will invariably stop moving to eat the feed.

Floor Plan

Figure 2 shows a floor plan that has the five major components of a breeding facility organized for human safety and biological function of animals. The benefits of this facility are: 1) a rapid estrous response occurs because there is a solid wall between the boar barn and the weaned sow and gilt area; 2) estrous sows remain in the breeding pen while the gate is open for the boar to enter because a mature boar (heat check boar) is housed between two breeding pens; 3) movement of boars is safe because they are moved in a circular flow and through

narrow alleyways; 4) the breeding pen floor is made non-slick because it is only used for heat-checking and breeding; 5) the boars are kept clean because of the slatted floor; 6) the solid wall allows the ambient temperature to be controlled differently between the boar and sow areas; 7) gates and gate latches are designed for quick and easy function, and 8) one person can operate the facility.

Figure 3 shows that the basic floor plan can be expanded easily with appropriate, advance planning. With this plan, the boars are initially kept in small pens because they are not used frequently. Additional boars can be added by either changing the small pens to stalls or adding on to the building.

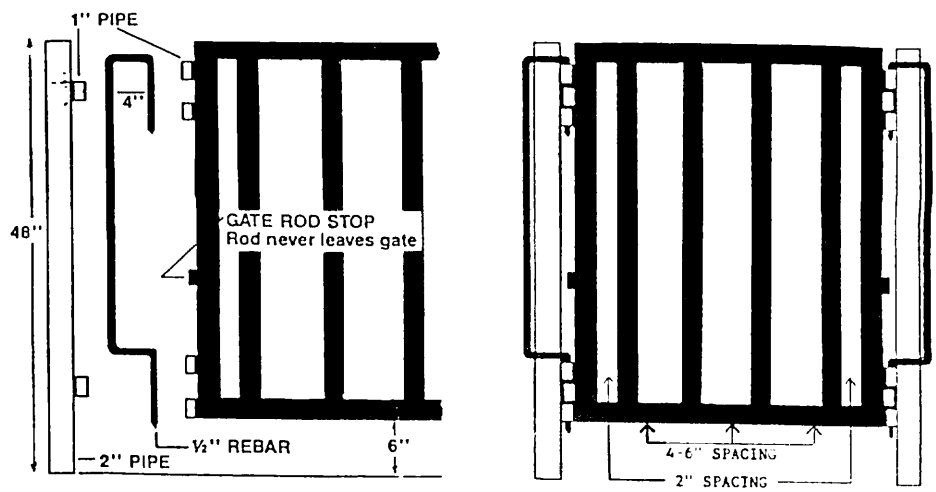

Figure 1. Gate latch design.

Table 1. Goals in Designing or Remodeling a Hand-mating Facility

Design factor		Goal to accomplish
1.	Efficient estrous detection	—rapid, strong immobilization response in female —female remains in breeding pen while gate is open for boar to enter —estrous female does not have to be shoved to a breeding pen —estrous detection can be easily done by one individual
2.	Animal movement	—any boar can be mated with any female in any breeding pen —animal flow is circular and never dead-ended —movement should be quick, easy, and safe
3.	Human movement	—no climbing over, crawling under, or going around gates and partitions —movement is safe and efficient —feeding animals is easy
4.	Gates and gate latches	—gates cut off alleyway —gates can be opened and closed with one hand —animals can not climb on gate —gate latch is quick and easy to use
5.	Breeding pen	—non-slick surface —easily cleaned —sized to be at least 8 ft^2 —only used for estrous checking and breeding
6.	Boar area	—easily expandable —option for using stalls or pens —safe and healthy environment for boars —adequate ventilation —prevents heat and cold stress —provides adaptability so boar barn can be built while: a) weaned sows and gilts are kept outside; b) weaned sows and gilts are kept inside for breeding and then moved outside for gestation, or c) the total sow herd is kept in stalls or small pens
7.	Facility construction	—design so building can be built in segments or easily expanded —design so pork producers can build their own facility —design so waste products (manure, urine, etc.) are easily managed

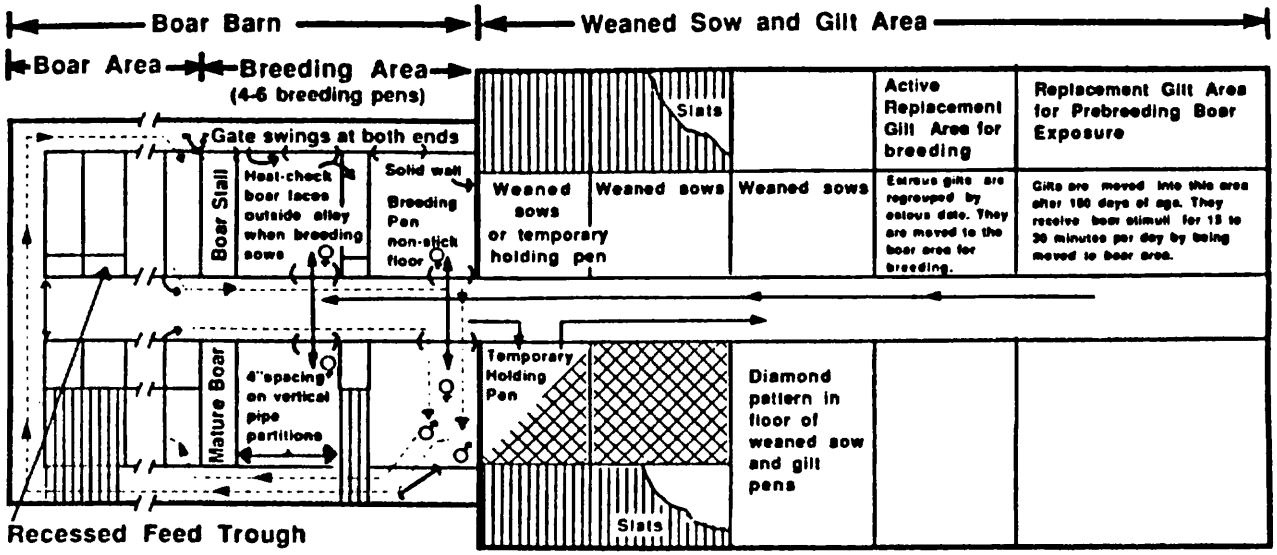

Figure 2. Hand-mating facility when sows are group-housed.

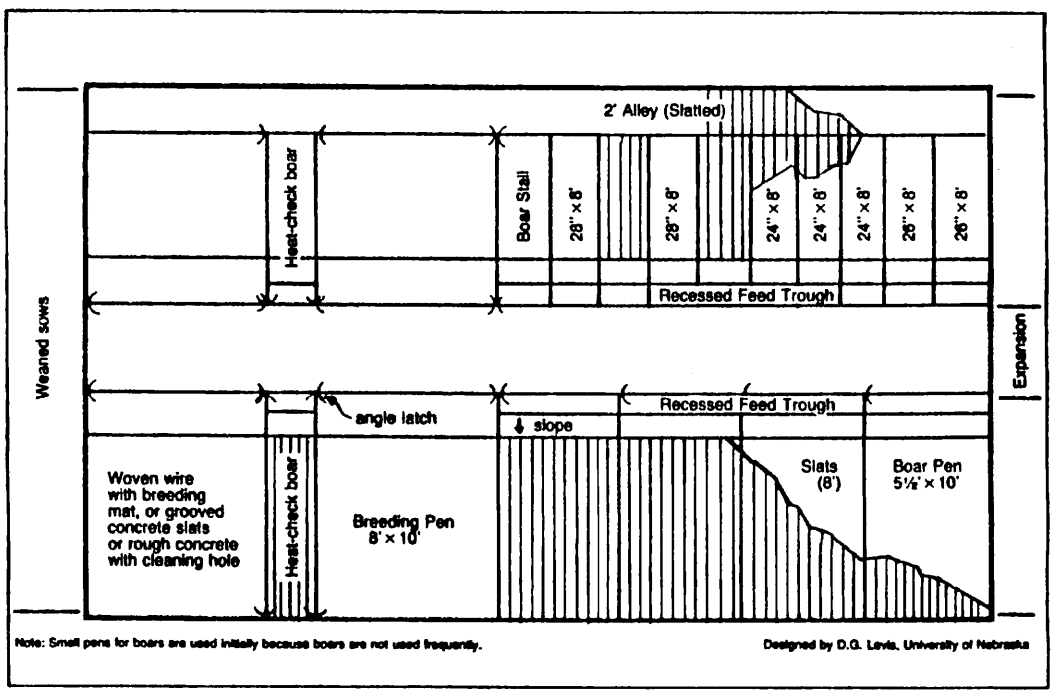

Figure 3. Breeding facility with built-in expansion.