



Stimulation and Detection of Heat in Gilts and Sows

Technical Report No. 12

Introduction

Profitability of the breeding herd increases as nonproductive days decrease. That's why it is important to keep nonproductive days low. This can be achieved by getting gilts bred promptly after they enter the breeding

herd and getting sows bred back as soon as possible after weaning. Understanding what promotes gilts and sows to cycle and show heat will help get them bred more quickly and reduce nonproductive days.

What Causes Sows and Gilts to Show Heat?

Prepubertal gilts and weaned sows show heat in response to increased estrogen that occurs as ovarian follicles ripen. Ripening follicles contain eggs which are ovulated after mating. When the eggs are ready to be fertilized, the follicles secrete estrogen to signify that the sow or gilt can be successfully mated.

The most important way a boar stimulates a gilt or sow to cycle and show heat is through the transfer of his pheromones (sexual odors) to a female's nose and mouth. The boar's pheromones are concentrated in his saliva. Physical contact is necessary for transfer of enough active pheromone to cause an optimal response by the female. These pheromones stimulate the gilt or sow's brain to produce certain hormones, causing them to cycle.

After puberty, gilts repeat a heat every three weeks until conception. In sows, a heat occurs about four to eight days after weaning, and repeats three weeks later if conception fails to occur. A gilt or sow may show signs of heat without displaying sexual behavior. For example, estrogen causes the vulva to swell and redden and stimulates an increase in mucus discharge. Sexual behaviors, such as standing-to-be-mounted, mounting other gilts or sows, erect ears and vocalizations, are voluntary actions controlled by the female's nervous system.

For this reason, boars insufficiently stimulate gilts and sows through fence-line exposure. Such exposure does not provide the physical contact necessary for transfer of heat-stimulating pheromones from the boar to the gilt or sow. Research shows that direct physical contact with a boar for at least 10 minutes per day is extremely important to trigger the highest occurrence and intensity of heat in gilts and sows.

Therefore, factors that influence the gilt or sow's nervous system can affect the occurrence and intensity of behaviors used to identify the gilt or sow in heat. Standing heat, for example, is influenced by physical contact with sexually active boars, penning with other sows or gilts in heat, heat or cold stress and footing conditions where the animals are housed.

Stimulation by Other Gilts or Sows in Heat

Sows already in heat can also induce heat in newly weaned sows. This is particularly true for first-litter sows and for sows weaned during the summer (Figure 2).

Boar Stimulation

Boars promote sows and gilts to cycle and show heat through a variety of stimuli. Optimal stimulation occurs when the boar is in direct physical contact with a gilt or sow compared to fence-line contact (Figure 1). This enables the sow or gilt to see, hear, smell and touch the boar.

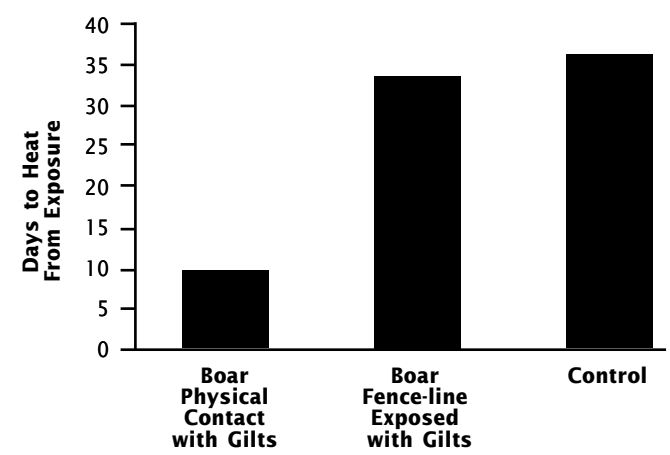


Figure 1. Days from exposure to first heat for 155-day-old gilts varies with boar contact as shown in the bar graph. Physical contact with boars for 20 hours a day resulted in the shortest number of days to heat—10 days. Fence-line exposure with boars for 20 hours a day resulted in approximately 35 days to heat. Gilts raised in pens at least 30 feet from the nearest boar (control) resulted in the highest number of days to heat—40 days. (Based on data from Deligeorgis et al., Anim. Prod. 39:145, 1984.)

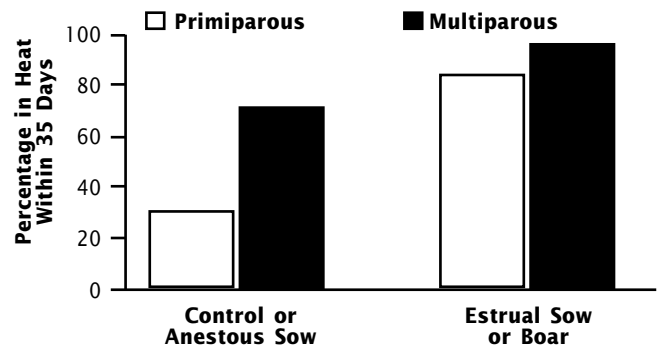


Figure 2. The percentage of primiparous and multiparous sows detected in heat within five weeks after weaning was highest for sows given daily contact with sows in heat or sexually active boars. The percentage of sows that were in contact with other anestrous sows or that had no contact (control) was less. (Pearce and Pearce, Vet. Rec. 130:5, 1992.)

Although the exact mechanism by which this occurs is unclear, many believe sows in heat produce an odor that stimulates other females to cycle. That's because studies with other mammalian species have shown that females grouped together tend to cycle together. Therefore, putting weaned sows in pens with sows already in heat may help stimulate the weaned sows to cycle more quickly.

There also is evidence that adding a fresh batch of gilts to an existing gilt pool will stimulate noncyclic gilts in the existing pool to show heat. New animals added to the pool somehow stimulate sexual behavior in the inactive females. The new animals may exert an effect similar to that seen for sows, because about half of new gilts added to a gilt pool will cycle within a week after being moved to the new location and given

daily boar exposure. However, prolonged exposure to a group of non-cyclic pen mates may lead to some sort of habituation that after a while provides little stimulation.

Because it's not profitable to keep noncyclic gilts in the gilt pool, you should cull gilts if they have not shown heat by some designated period of daily contact with a boar. The amount of time before culling varies with the age of the gilt at first exposure and with genotype. In general, gilts that are five to six months old at first exposure show heat in four to six weeks if given proper stimulation.

Housing in Pens Versus Stalls

Studies comparing effectiveness of pens versus stalls on the resumption of sexual activity are basically inconclusive. This is probably because the manner in which boar exposure is provided to females is far more important than the housing system. Regardless of whether the female is housed in a stall or pen, the key concept is that females need intense periods of contact with the boar.

For females housed in pens, move the females to the boar pen or a breeding pen and not vice versa. Concentrations of heat-stimulating boar pheromones are much higher in a boar or breeding pen than in a gilt or sow pen. Thus, movement of females to the boar results in considerably more intense exposure of females to pheromones and a higher percentage of females exhibiting estrus (Table 1).

Reference	Percentage of Gilts in Heat		
	Control	Boar to Gilts	Gilts to Boars
Scheimann et al. J. Anim. Sci. 43:210 (abtr), 1976	31	41	78
Van Lunen & Aherne Can. J. Anim. Sci. 67:553, 1987	29	48	68

Table 1. Effectiveness of boar contact on stimulation of heat in gilts when conducted in the pen of the gilt or the boar (Hughes et al., *J. Reprod. Fertil. Suppl.* 40:332, 1990)

The number of females housed in pens also influences the efficiency of estrous detection. As the number of females in a pen increases, the effectiveness of the boar decreases. There are two basic reasons for this. First, as female numbers increase, the amount of time that a boar spends in close proximity to each individual animal decreases, reducing the amount of intense boar contact per female. Second, as the number of females per pen increases, social competition among animals tends to increase which also may suppress the effectiveness of boar exposure. A good rule of thumb is to limit pen density to no more than eight to 12 females and to provide at least 19 square feet per sow.

For females housed in stalls, boar stimulation also is most effective when the female is moved from her stall to a boar or breeding pen and given 10 minutes of daily exposure. A common practice is to provide boar exposure to sows in stalls by either penning a mature boar behind or in front of weaned sows and checking for estrus with the back pressure test. However, these management practices do not provide maximum boar exposure. When boars are placed in pens behind stalled females, the intensity of boar exposure is reduced because the nose and mouth of the female are not in direct contact with pheromones the boar produces.

When boars are placed in pens in front of stalled females, the intensity of the male effect also tends to be reduced unless the boar pen is directly in front of the stalls. A distance as little as three feet, about the width of an alleyway, is enough to reduce boar stimulation and the accuracy of heat detection (Table 2).

Is Estrous Detection More Efficient When Conducted Outside or in Confinement?

Intensity of exposure is the key to successful heat detection. Intensity of exposure to boars is more difficult outside than inside. That's because many factors in the outside environment, such as temperature, humidity and wind velocity, dilute pheromones and boar stimulation. If you have to check for heat in outdoor pens, force the boar to mingle with and stay in relatively close proximity to sows and gilts. It may be best to have a separate, smaller pen that is used just for heat detection rather than allowing a boar to roam through a pasture of weaned sows.

Does the Configuration of Pens in the Breeding Barn Influence the Effectiveness of Boar Exposure?

The answer to this question is a resounding yes! There are several different configurations that have proved very effective. Most of these follow three general rules:

1. Keep the boar pens close to the breeding or heat detection pens;
2. Keep weaned sows and mature gilts housed in such a way that once they come into estrus they can be moved away from continual boar exposure;
3. Keep prepubertal gilts housed near the boar pens until they exhibit estrus.

For full effect of boar exposure, make the boar and breeding pens the central focus of the pen arrangement. Ideally, the breeding pens should have the highest concentrations of pheromones to maximally stimulate the sow during estrous detection. This is accomplished by either breeding in the boar's pen or having the breeding pens adjacent to boar pens.

It also is important to remove females from continual exposure to males once you've detected that they are in heat. This prevents habituation. Habituation, which occurs when females are given continual boar exposure, usually results in poor standing reflexes and/or short, erratic periods of heat. It occurs because females do not receive the brief intense periods of boar exposure necessary to maximally stimulate the behavioral aspects of estrus. Instead, under continual exposure, they become accustomed to or "habituated" to the boar.

Fence-line contact with a mature male helps stimulate prepubertal gilts to undergo the physiological processes that result in estrus, but fence-line contact needs to be reinforced by intense periods of daily, direct physical contact. This will help stimulate the behavioral aspects of estrus. Once gilts have been detected in estrus, and if they are to be bred at a later date, it is a good idea to move them to another pen away from continuous exposure. This will prevent habituation. However, in order for them to exhibit estrous cycles on a regular basis, they need short periods of daily boar exposure.

	Location	
	Aisle Adjacent to Boar	Gilt Pen, 3 Feet Away
Gilts detected in heat, %	90	52
Gilts mated, %	87	52

Table 2. Effect of conducting the back pressure test in the aisle directly adjacent to the boar or in the gilt pen approximately three feet away (Hemsworth et al., *Anim. Behavior Sci.* 12: 339, 1984)

What Types of "Stresses" Influence How Females Respond to Boar Exposure?

Basically, any type of stress during boar exposure is undesirable. Interactions between boars and sows during estrous detection are physically demanding on both sexes. Additional stresses during heat detection usually reduce

the effectiveness of the boar and the intensity of the signals he produces, decreasing the reception of his signals by the female.

Conditions commonly encountered in most operations that have a negative effect on boar stimulation are heat stress (>85°F), cold stress (<35°F), physical stress (poor footing in breeding pen) and social stress (rough handling of animals during movement to and from the breeding pens). The best way to alleviate the effects of stress during estrous detection is to minimize such conditions. For environmental stresses, maintain an adequate thermal environment. To alleviate temperature effects in outdoor situations, detection of estrus should not be done in the coolest and warmest portions of the day, respectively, during periods of potential heat or cold stress. Finally, breeding pens with good footing and calm, careful handling of animals during heat detection should maximize the effectiveness of boar stimulation of sexual activity in sows and gilts.

Conclusion

Maximizing profitability in the breeding herd requires shortening the interval from the time the female enters the breeding herd until she conceives. This can be accomplished by using proper boar stimulation and detection techniques. Providing physical contact with the boar is the most effective way to induce heats in gilts and sows and maximize sexual behaviors, resulting in easier heat detection.

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