Artificial Insemination: Estrus Detection and Insemination

Timing and technique are two key factors in the successful use of AI. They both require well-trained staff, well-planned facilities and adequate time to do the job properly.

Facilities
Accurate estrus detection is best carried out with the sow or gilt having complete freedom to express its physiological state. In practice, this rarely is possible for sows, as usually they are weaned directly into crates. Gilts on the other hand, are commonly housed in group pens prior to service. In this situation, their behavior towards each other, and to a freshly introduced boar can be of great value in detecting estrus.

For insemination purposes, the ideal arrangement is for each animal to be housed individually, so that it can be given the required level of stimulation without being disturbed by other animals. Here, the crated sow is in the ideal facility, provided that adequate manual and boar stimulation can be given. Inseminating a gilt in a group can be much more challenging.

While facilities rarely are ideal, it is helpful to bear in mind the optimum arrangements, compensating where necessary, for any element missing from the equation.

Estrus detection in sows
Accurate timing depends upon accurate estrus detection. The timing of AI in relation to ovulation is important, and the timing of ovulation so variable, that it is preferable to carry out estrus detection twice a day. Where estrus detection is carried out twice a day, the second session should take place as near to the end of the day as possible, and certainly a minimum of 6 hours after the first session. Where time does not allow twice daily estrus detection, AI timing will have to be adjusted (see below). It is better to do a good job once a day, than to rush the job and do it badly twice a day.

It is important that sows are freshly exposed to the boar at the start of an estrus detection session. For this reason, the boars should not be housed close to, or in contact with the sows overnight. Ideally, they should spend the night in a different airspace, or at least the other end of the breeding barn from the freshly weaned sows. Continual boar exposure can lead to habituation and refraction in the sows, making estrus detection difficult and less accurate.

Sows need short intense periods of exposure to a mature boar in order to help stimulate onset of estrus, and to identify estrus when it occurs. There is no substitute for boar
presence in this important and time-consuming process. Nose to nose contact between the boar and each sow is essential when checking for estrus. Ideally, use an old chatty boar that produces plenty of saliva, to walk in front of all freshly-weaned sows. A member of staff should walk along behind the sows at the same time, checking each animal for signs of estrus, including a standing response to the back pressure test in the presence of the boar. Rubbing the sow’s underline and flanks can encourage a response. Restrict the movement of the boar by using boards/gates or a second member of staff, to make sure that each sow gets adequate stimulation. Alternatively, the boar’s movement can be controlled by use of a leash or tether, with one operator dedicated to this purpose.

A vasectomized boar may be used for stimulation, particularly in the group situation. Whatever boars are used for estrus detection, keep them interested by allowing them a natural service occasionally. Do not allow estrus detection to be influenced by the presence of food; carry out at least 30 minutes after feeding in the morning.

**Estrus detection in gilts**
The gilt pool is an important but expensive investment. Managed carefully, it will provide gilts for service whenever required, ensuring that service targets are met every single week. 20 minutes daily exposure to the boar can encourage the onset of puberty in gilts. Ideally, this should take place by having the boar walk through each batch of gilts in turn, under the supervision of a stockman. Any gilt showing signs of estrus should be recorded, even if no mating is planned at that time. Daily stimulation and estrus detection in the gilt pool will allow gilts to be served at the planned time (i.e. at their second/third estrus) with some accuracy, and also ensure that any problems with failure to cycle are identified at an early stage.

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**Pointers for Successful Heat Detection**

<table>
<thead>
<tr>
<th>Vulva Reddens, Swells &amp; Subsides (approximately 4 days)</th>
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| 1: 1st Service
| 2: 2nd Service
| 3: 3rd Service |

<table>
<thead>
<tr>
<th>Male Characteristics</th>
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<tbody>
<tr>
<td>Standing to Boar (heat period) (approximately 2 1/2 days)</td>
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<tr>
<td>Honking Stage</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Fertility</th>
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<tbody>
<tr>
<td>Low: Do Not Inseminate</td>
</tr>
<tr>
<td>High: Inseminate</td>
</tr>
<tr>
<td>Low: Wait Until Next Time</td>
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<table>
<thead>
<tr>
<th>Hours</th>
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<tbody>
<tr>
<td>4 3 2 1 0 1 2 3 4 6</td>
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<table>
<thead>
<tr>
<th>Points</th>
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<tbody>
<tr>
<td>A: Detect</td>
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<tr>
<td>B: Delay</td>
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<tr>
<td>C: Inseminate</td>
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**Standing to “back pressure test” (approx. 1 day)**
**Behavior changes through the estrus cycle**

Remember that no two animals are exactly the same. The signs of the various stages of the estrus cycle described below may be seen in various combinations, to a greater or lesser extent.

**As estrus is approaching:**
- Restlessness
- Climbing
- Loss of appetite
- Watery discharge
- Bar biting
- Grunting, honking, whining
- Color of the vulva may be cherry red and heavily swollen

**Standing Estrus:**
- Pricked ears
- Loss of appetite
- Standing reflex
- Arched back
- Trembling
- Glazed eyes
- Tail upright and flicking up and down
- Mucus discharge from vulva
- Reddish pink, slightly swollen vulva
- Positive response to the “back pressure test”
- Average duration: 1-2 days per gilt; 2 – 3 days per sow

**Timing of insemination**

Viable sperm must be present in the sow’s uterus before ovulation occurs. After ovulation, the oocytes (eggs) have a short lifespan of about 8 hours. Once inside the sow’s reproductive tract, sperm cells survive for around 24 hours. Ovulation timing is variable, but real-time ultrasound studies have shown that it appears to correlate with the weaning to estrus interval, and the duration of estrus in an individual sow or gilt. In the diagram below, sows have been divided according to their weaning to estrus interval:
- Sows with a short (3 day) weaning to estrus interval tend to have an extended estrus period which can last 2-3 days.
- Sows with a standard 5-day weaning to estrus interval have an estrus period lasting 36-48 hours.
- Sows with a delayed weaning to estrus interval of 7+days are likely to have a relatively short estrus period of only 24 hours.

In all three groups, ovulation occurs approximately 66-75% into standing estrus. Whilst this study was based on a small number of farms, the pattern can be applied to all units.
Ovulation timing

Late Standing

Normal Standing

Early Standing

Days 1 2 3 4 5 6 7 8

Weitze, et al. 1994

Boar test positive
Back pressure positive
Ovulation
Optimal insemination timing
Lifespan of semen
The key for the individual farm is to study estrus duration in relation to the weaning to estrus interval, and to establish its own optimum insemination regime from that, remembering that ovulation will happen towards the end of standing estrus. The length of standing estrus will vary between genetic lines, and between farms.

If checking for estrus twice daily, aim to give the first AI dose 12–18 hours after the first signs of standing estrus. Checking for estrus only once per day will reduce the accuracy of detecting its onset, and the first AI dose should be given immediately. In either case, a second AI dose should be given up to 24 hours later.

Note that inseminating a sow as estrus is subsiding is a waste of time and semen, as ovulation will have occurred already. Also, it increases the risk of uterine infection and vaginal discharges. Never inseminate a sow at this time – even if you have only inseminated the animal once before during the estrus period.

**Insemination equipment**

Equipment for inseminating a sow or gilt is quite simple:

- Your choice of disposable insemination catheter (spiral or sponge-tipped).
- Lubricant (make sure it is non-spermicidal).
- Clippers for trimming off the end of the insemination tube (if required).
- Paper towel.
- Note book and pencil for recording the event.
- Insulated semen box for holding the semen prior to AI.
- Semen doses checked for use-buy date, line/batch/boar.
- Clean hands!

**Insemination technique**

The insemination technique is not difficult, provided that practical training has been given; it is also helpful to have an understanding of the anatomy of the sow’s reproductive tract. It requires a firm, gentle and patient approach. Each sow should be treated as an individual, being given the right level of stimulation to optimize the standing response, and to promote sperm transport through the uterine horns en route to the oviducts (site of fertilization).

Move a large, chatty, smelly old boar to the front of 2-3 estrous sows for stimulation. If the sows have to be moved to the boar, be gentle, and avoid any unnecessary stress. Changing the boar frequently helps to maintain interest. Make sure that each sow is on standing estrus before starting the insemination. If the sow is not showing signs of standing estrus, do not force an insemination. Identify the female, record the ear tag number and also the semen dose to be used.

Hygiene is most important during AI, and great care should be taken to avoid introducing infection into the sow’s reproductive tract throughout the process. A fresh catheter should be used for each insemination. The tip of the catheter must be kept clean as it is introduced through the vulval lips into the vagina and cervix.
First of all, clean the vulva with dry single-use paper towel, if necessary. Apply back pressure and rub the underline to pre-stimulate. Take the catheter from a sealed bag (make sure that the bag is resealed to avoid contamination). Apply a non-spermicidal lubricant (e.g. KY-Jelly™) to the tip of the catheter. Gently part the lips of the vulva and insert the tip of the catheter into the vagina pushing forwards and upwards. This should be carried out gently to avoid stress and damage.

For spiral-tip catheters:

- Introduce the catheter forwards and upwards into the vagina, rotating counterclockwise as it progresses. After several inches (this distance depends upon the dimensions of the sow) resistance is encountered - the catheter will now be positioned at the opening of the cervix.
- Continue to rotate counterclockwise until ‘spring-back’ is felt – at this point, a “lock” has been achieved. Gently pull back on the catheter until you feel resistance as the walls of the cervix hold the catheter in place.
- If there is no “lock”, you may need to remove the catheter and start again (using a new catheter).
- Make sure you have the correct dose of semen.
- Re-suspend the sperm cells by gently rotating the dose.
- Continue to stimulate the sow by rubbing the flanks, and ensuring that there is good boar contact.
- Open the dose of semen, and attach it to the stem of the catheter.
• Lift the catheter and the semen dose, and semen should start to flow into the sow. If this does not happen, apply gentle pressure to the dose - avoid heavy pressure as this will force semen out through the vulva to be wasted.
• Sitting on the back of the sow or applying back pressure, and rubbing the underline all help in the stimulation process, causing the sow to release oxytocin which helps with sperm transport.
• A normal service will last from 5 – 10 minutes; gilts often take longer.
• Constant boar and inseminator stimulation must take place throughout the insemination.
• To ease the flow of semen or to minimize leakage it may be necessary to rotate the catheter either clock/counterclockwise at some point during the insemination.
• Allow time for the catheter to empty into the uterus. The presence of the catheter in the cervix continues to stimulate the sow at this time.
• After a few minutes, the catheter may be removed by rotating the catheter in a clockwise direction.
• The first insemination is now complete.
• It is essential that a new catheter is used for each individual insemination in the interests of hygiene.

For sponge-tip catheters
• Use the same procedure as for the spirette with regards to cleaning and insertion.
• Once inserted, the sponge-tip catheter is designed for a push fit.
• Push the catheter firmly into the cervix.
• The sponge-tip runs over the spiral walls of the cervix before becoming “locked.”
• This type of catheter forms a good seal, and is unlikely to enter the bladder due to the shape and dimensions of its head.
The insemination belt
Providing adequate stimulation for each sow throughout AI is time-consuming but extremely important. Many farms are now making excellent use of an insemination belt, wrapped tightly around the flanks of the sow in order to provide some of the required stimulation. It is also designed to hold the insemination dose, facilitating “hands-free” insemination. It works best where good nose to nose contact with a boar is also provided, and where sows that fail to settle once it is fitted can be treated more individually and manually by the AI technician. The AI belt is a useful tool, but in no way substitutes for good insemination practice.
Semen handling on the farm
Semen should be stored in an incubator at 17-18°C from processing until it is to be used. Resuspend the sperm cells by rotating all the doses in storage. Prior to an insemination session, calculate how many semen doses will be required, and check that each dose is within its shelf-life, and from the required boar/line/batch. Place the doses into an insulated transport box, to take them to the breeding barn. Where a large number of inseminations are to be carried out, take only sufficient semen doses for about a one-hour session. Return to the incubator as required for further doses. This will avoid semen doses being exposed to damaging fluctuations of temperature. Semen doses should never be returned to the incubator. If they have been removed and then are not required, they should be discarded.

Post-AI management
Sperm transport through the sow’s reproductive tract from the cervix to the oviducts (site of fertilization) is achieved by contractions of the muscle layer of the uterus. These contractions are a response to release of oxytocin, which occurs when an estrous sow is being stimulated adequately by boar presence and/or manual stimulation. Sperm take 15-20 minutes to make the journey to the oviducts, and throughout this time, efforts must be made to maintain the appropriate level of stimulation. Moving a sow immediately after AI can have a deleterious effect on uterine contractions, and therefore can reduce sperm transport. It is good practice to leave a sow standing quietly wherever the AI took place, preferably in contact with a boar, for 15-20 minutes, in order to promote sperm transport and enhance fertility.

Equipment manufacturers
The equipment and consumable items mentioned in this text is available from: