Artificial Insemination in Goats

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Introduction

Genetic improvement in livestock entails the selection of the animals with the "best" set of genes and allowing only them to reproduce. However, the "best" animals may not be available locally within the goat producer's herd or may be deceased. Artificial insemination using frozen semen can overcome these two obstacles. The use of either frozen or fresh semen can preserve biosecurity measures so that disease transmission from animal-to-animal or farm-to-farm is minimized. Artificial insemination is a relatively simple tool to employ but requires some technical knowledge.

Heat or Estrus

The average length of the estrous cycle in goats is 21 days, with a normal range from 19 to 23 days. Estrus or heat is the period of time in which the doe (female) is sexually receptive to the buck (male). Does are in estrus for approximately 24 hours and ovulate at the end of estrus.

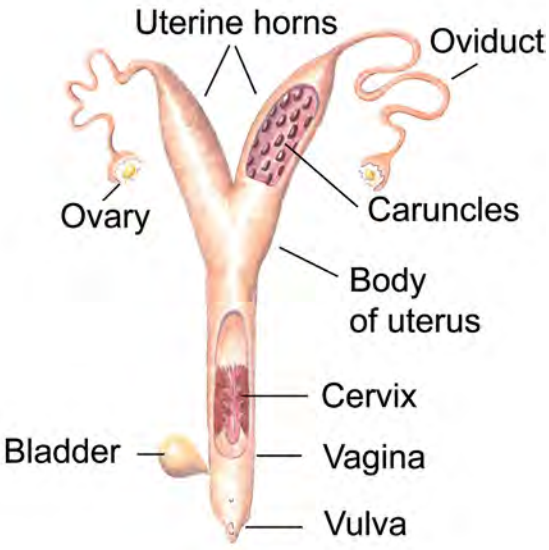
Estrous Cycle of Goat-Terminology

Estrus, or heat, is the period when the female is most sexually receptive, due to high levels of estrogen, and lasts 24 to 36 hours. Increased estrogen levels bring about a surge of LH, which triggers ovulation toward end of estrus.

Metestrus is the period when the corpus luteum forms and begins to produce progesterone. Metestrus lasts 2 to 3 days.

Diestrus is the period when the corpus luteum is highly active in its production of progesterone. If pregnancy occurs, the corpus luteum is maintained and further estrus is inhibited. If pregnancy does not occur, prostaglandin from the uterine wall causes regression of the corpus luteum. Diestrus lasts 15 to 19 days.

Proestrus is the period between the regression of the corpus luteum and estrus, when follicular development is occurring, and estrogen production is increasing. Proestrus lasts 2 to 3 days.



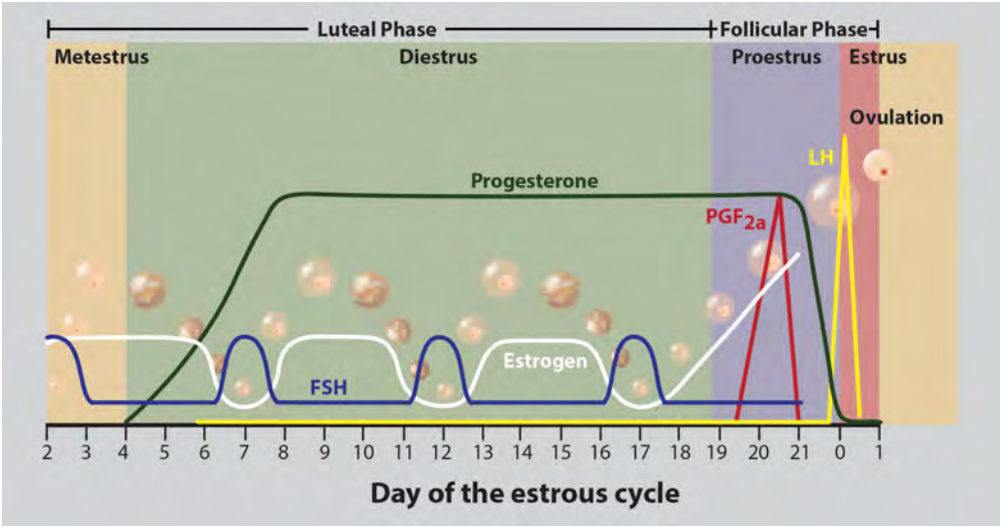
Signs of estrus

Most does exhibit easily recognized signs of estrus such as:

- fence walking
- tail wagging or flagging
- swollen vulva
- homosexual activity (mounting or allowing pen mates to mount)
- increased urination
- increased vocalization
- increased restlessness and head butting with other females
- increased vaginal mucus discharge
- decreased appetite
- decreased milk yield
- other personality changes

For artificial insemination, possibly the most important sign is the change in consistency, elasticity, and color of the vaginal mucus and is assessed by examining the mucus located in the anterior portion of the vagina, also called the fornix. A speculum and light source are required for this assessment. For optimum fertilization, the mucus should be thick, highly elastic, and cloudy. Mucus that is thin, water-like, and clear is an indication that the doe is too early in estrus for a properly timed insemination. Mucus that is thick, pasty, and white or pale yellow is an indication that the doe is past her proper time.

If possible, the inseminator should keep records on each doe to determine her regular cycle. Good records are a key element in good herd management and are important in the accurate determination



of standing heat and also the entire length of her estrous cycle. Does remain in estrus for approximately 24 hours, although this can vary from breed to breed and from doe to doe within breed. Generally, an individual doe will likely repeat the length of her estrus and the length of her estrous cycle on a regular basis.

Timing

The timing of insemination is the most-important factor in determining the success of artificial insemination, and timing is dependent upon successful detection of estrus. Under natural mating, the buck is the best indictor of the receptiveness of the doe. The buck will commonly exhibit a Flehmen reaction when assessing the mating receptiveness of the doe. The Flehmen reaction is when the buck curls his upper lip and inserts his muzzle into the urine stream of a female. The inseminator does not possess these advantages and must rely upon other signs/indications of estrus and for the determination of proper timing of insemination.

Technique

Artificial insemination is a simple technique that, when performed with skill properly founded on knowledge, offers ease of use and a good level of success. However, results can be discouraging for an inseminator lacking knowledge and the necessary attention to details needed for a successful outcome.

It is good to keep in mind that the success of any artificial insemination program is largely dependent on three primary factors:

- The use of live/viable fresh cooled or frozen semen.
- The appropriate timing of insemination in relation to estrus and ovulation.
- The proper deposition of semen in the doe.

Not every doe is a good AI candidate. Does who do not cycle normally every 17 to 24 days with regularity or who are difficult to determine when and if they are in estrus should be lesser candidates in an AI program.

Success Rate of AI by % Pregnancy Rate (PR)

Method	*PR (%)*
Vaginal	< 15-25
Cervical (CAI)	<40-45
Transcervical (TAI)	55-65
Intrauterine (LAI)	80-90

Under natural service (using a buck), the buck deposits the semen in the fornix of the vagina and the success (pregnancy) rate is generally near 95%. If the inseminator deposits semen in the same location, the pregnancy rate is generally less than 25%. If the inseminator is unable to traverse the cervical rings and deposits the semen within the cervix, then the pregnancy will nearly double to 45%. If the inseminator is successful in traversing all the cervical rings and is able to deposit the semen in the body of the uterus, then pregnancy rate can rise to near 65 to 70%.

Proper semen deposition

Many inseminators will check heat once in the early morning and once in the late afternoon with a teaser buck or an intact buck outfitted with a mating apron. Those does found to be in standing heat in the morning are scheduled to be inseminated in the afternoon and does found in standing heat in the afternoon are scheduled to be inseminated the next morning. If a doe is still in standing heat at the next heat check, then a second, or even a third, insemination can be scheduled. This decision is contingent upon the price of the semen and the availability of the inseminator. The mucus consistency, elasticity, and color should be verified on the does scheduled for insemination. If the mucus has the proper properties, then insemination can continue. If not, the doe should be returned to the herd and heat check procedure continued.

Determining the proper time to inseminate is not only critical with regard to the condition of the spermatozoa and ovum (egg) when they come in contact with one another, but also is critical to facilitate proper placement of semen in the reproductive tract. It is necessary that proper timing be achieved to allow the artificial insemination gun to penetrate and traverse the cervix prior to semen deposition. A properly timed procedure should allow for relative ease in manipulating through the cervical rings. However, young or maiden does will prove markedly more difficult and are not advised for the beginning inseminator. Even mature does, if stressed or made uncomfortable due to rough handling, poorly designed or ill-used equipment, can become so tense as to constrict

the muscular canal of the cervix rendering its penetration past the os (opening of cervix) nearly, if not totally, impossible. It cannot be overstressed that artificial insemination should be performed with a slow, determined, but gentle approach with adequate time allowed to follow proper protocols.

Semen should be deposited within an approximation of like timing to the occurrence of ovulation. Ovulation occurs just before or shortly following the end of the doe's standing heat. Once the semen is properly deposited, it is believed that fresh semen can remain viable for over 12 to 24 hours in the doe's reproductive tract. Processed and frozen semen is compromised to some degree and can be expected to have a somewhat shorter time of viability.

Artificial insemination equipment and supplies

Some basic equipment is required for the inseminator to perform cervical and/or transcervical insemination effectively. Ultimately the doe's comfort should be in the forefront of the inseminator's mind in the selection of tools to use.

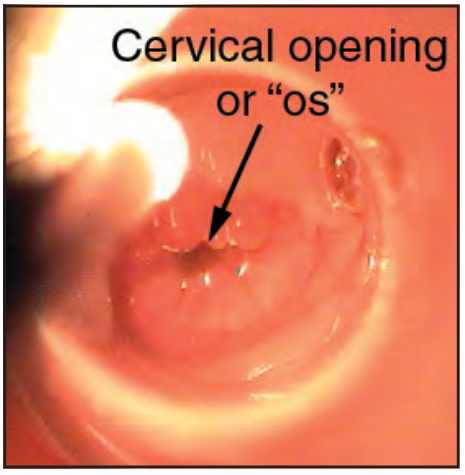
Basic equipment necessary for artificial insemination includes:

1. Carrying case.
   - A compact metal or plastic case for the safe and clean storage of equipment.
2. Artificial insemination (AI) gun.
   - A goat length (usually 30 cm) device used for the depositing of semen via a ¼ or ½ cc straw; available in a variety of styles.
3. AI gun sheaths.
   - Disposable, sterile, individually wrapped outer plastic shells which fit over the gun providing a secure seat for the straw. Each AI gun requires a specific style of sheath to accommodate the gun's specific design.
4. AI light.
   - A compact light source which should attach securely to the vaginal speculum. The most easily used light sources are independent of a battery pack, generate little to no heat, and are unobtrusive in design.
5. Vaginal speculum.
   - When used in conjunction with a light source, enables the clear view of the cervical os (opening of cervix).
6. Speculum brush (bottle brush).
   - A soft brush, sized to provide thorough cleaning of the vaginal speculum.
7. Straw cutter or scissors.
   - For proper seating in the AI gun sheath, this device delivers the critical square cut to the end of the semen straw. Scissors will work well as a cutter. However, scissors tend to flatten the end of the straw and the end of the straw needs to be rounded with a gentle roll of the fingers before it is inserted into the gun.
8. Non-spermicidal, sterile lubricant.
   - Used for the lubrication of the vaginal speculum prior to its insertion.
9. Semen thaw unit.
   - A device designed for the proper control of the semen straw's thawing process. The unit should be compact in design, providing optimal thermal protection, complete with a thermometer, as well as both water and dry bath compartments.
10. Straw tweezers.
    - Used for the retrieval of straws from the liquid nitrogen tank and from thaw unit. Available in both 0.25 and 0.5 cc sizes
11. Other items needed:
    - Fresh cooled or frozen semen. Packaged in ¼ or ½ cc straws.
    - If using frozen semen, additional required equipment includes:
      - Liquid nitrogen storage tank.
        - Available in a variety of sizes, storage capacities, and duration of hold times; an over-sized thermos of a sort, to be filled with liquid nitrogen, for the long term cryogenic storage of semen.
      - Liquid nitrogen tank measure stick.
        - For the measuring and accurate monitoring of the volume of liquid nitrogen contained within the storage tank.
12. Optional equipment includes:
    - Microscope.
      i. Of mid-grade or better quality with a tungsten or halogen light source and capable of examining specimens at a minimum of 100× and 400× magnifications; used for basic thawed semen observations and analysis.
    - Microscope slides.
      i. The platform on which the thawed semen sample is dispensed for viewing with the microscope.
    - Microscope cover slips.
      i. A small piece of plastic or glass used to cover the semen sample, allowing its proper viewing.

Goat AI Procedure

1. Assemble equipment.
2. Restrain doe.

3. Wipe dirt from around vulva – no soap is used as this is spermicidal.
4. Put lubricant on the speculum.
5. Insert speculum into vagina and attach light source.
6. Locate os of cervix (opening of cervix).



7. Evaluate os (opening of cervix)– does it appear open or closed.
8. Evaluate mucus – is it clear (early heat) or somewhat cloudy (later heat, more appropriate for insemination).
9. If doe is ready for insemination remove speculum.
10. Thaw semen.
11. Remove from semen tank and put in thaw jar within 3 seconds.
12. Thaw jar temperature should be 95°F (35°C).
13. Thaw semen for approximately 15 – 30 seconds, can be longer.
14. Remove straw from water, wipe off water.
15. Cut the crimped end with straw cutter, do not cut end with plug.
16. Load into insemination gun.
17. Put on appropriate sheath.
18. Keep gun warm until needed.
19. Reinsert speculum as described previously.
20. Locate os (opening of cervix)of cervix.
21. Insert insemination gun into os and try to penetrate into cervix.
22. Generally there will be 5 cervical rings, count the rings as they are passed.
23. Do not deposit semen into a uterine horn, deposit inside cervix.
24. Deposit semen slowly over at least 5 seconds, watch the cervical opening to see if any semen "backs up" out of the cervix.
25. Slowly remove the insemination gun to avoid creating a vacuum effect pulling semen out of the cervix.
26. Remove the speculum and record time of mating, buck number, doe number, mucous characteristics, inseminator's name, comments on heat characteristics, any further comments.
27. Place the speculum in a bucket of water to wash.
28. Speculums can later be sterilized by boiling or baking, dried and individually wrapped in paper towels until next use.

Conclusions

Artificial insemination in goats is a simple non-invasive procedure but takes skill to master, especially in judging the correct time to inseminate.

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