



Enhancing Reproductive Performance in Small Ruminants:

Part VI. Reproductive Management Techniques

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This series of fact sheets has been designed to assist producers in enhancing reproductive performance in their herd so that overall production can be optimized to promote profitability. Fact sheet topics included in the Enhancing Reproductive Performance in Small Ruminants series include:

Part I. Biology of Reproduction

Part II. Puberty and Estrous Cycles

Part III. Breeding and Management Systems

Part IV. Breed/Selection

Part V. Nutrition and Health

Part VI. Reproductive Management Techniques

An important part of this discussion involves preparing female meat goats and hair sheep for the breeding season. A fact sheet on this topic is available online at https://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/APSC/apsc-143/APSC-143.pdf

Estrus Synchronization/ Induction

Estrus synchronization allows for kidding/lambing at appropriate times to take advantage of feed supplies, labor, specific markets, and price trends. Methods of estrus synchronization in sheep and goats include hormonal treatments (e.g., natural progesterone, progestogens, and prostaglandin), and manipulation of social inputs (male effect). Estrus induction allows initiation of cycling in seasonally anestrus females and requires the use of progesterone and/or treatment with light.

Administration of progesterone tricks the body into thinking it is pregnant; its subsequent removal results in females cycling and demonstrating estrus in a predictable timeframe (within 24-48 hours). Currently, a controlled internal drug-releasing device (CIDR) (figure 1) in the form of a silicone intravaginal natural progesterone insert is approved for use in sheep and is available for purchase in the U.S. The device, Eazi-breed CIDR, is FDA-approved for use in sheep; its approval for use in goats is pending. This product has become especially important in the development of effective synchronization protocols for artificial insemination (AI) in small ruminants. Progesterone administration can be used with or without supplementary treatments, such as gonadotropins (hormones that promote follicle growth and ovulation/release of egg) or prostaglandin (lyse an active corpus luteum) for increased synchrony. Please note that gonadotropins and prostaglandins are not approved for use in small ruminants and are considered extra-label use. However, CIDR treatments are effective when used alone in synchronizing estrus. Most protocols recommend inserting for eight to 12 days. For out-of-season breeding and transition periods (late summer/early fall), more progesterone priming might be necessary so longer insertion periods would be needed.

An alternative and more practical method of administering progesterone is by oral dosing in feeds. Melengestrol acetate (MGA) is a synthetic progestogen that was first used in the dairy industry to suppress heat in heifers. The use of MGA to induce estrus in seasonally anestrus ewes and does has been well documented and, when used in conjunction with



Figure 1. A controlled internal drug-releasing (CIDR) device and loaded applicator. (Reprinted with permission from Stephen Wildeus, 2005.)

a co-treatment, has been proven to be effective (figure 2). A rate of 0.25 milligrams MGA/female/day for 8 to 14 days alone or in combination with the male effect can be used. Similar to the use of other progestogens, the use of gonadotropins and prostaglandin analogs may assist in further tightening synchronization. The major issue with this method appears to be administering the feed, since group feeding has the possibility of some females getting too much or too little of the required dose to synchronize/induce estrus. Individual feeding or ensuring that there is sufficient feeder bunk space should prevent this from occurring.



Figure 2. Estrus synchronized St. Croix ewes using MGA. (Reprinted with permission from Stephen Wildeus, 2005.)

The use of a prostaglandin has also been shown to be effective in synchronizing cycling females and offers a flexible, economical method to shorten the breeding season. A typical prostaglandin protocol includes two injections 11 days apart. This is necessary because in order for prostaglandin to be effective, it requires an active corpus luteum (CL) present on the ovary to act on. Therefore, the second injection ensures an increased chance of lysing the CL and allowing the female to return to estrus faster. The most commonly available prostaglandin is dinoprost tromethamine (Lutalyse; Pharmacia and Upjohn Co., Kalamazoo, Michigan) but cloprostenal (Estrumate) is also available for use. It should be noted that prostaglandin might cause abortions if administered to pregnant females.

Exposure to males after a period of isolation can be used for estrus synchronization during the breeding season without additional treatments. Research has shown that sudden introduction of the buck/ram to females separated from the male for several weeks (more than three weeks) will result in a surge in luteinizing hormone, which is responsible for ovulation/egg release, and a rise in progesterone concentrations,

allowing a proportion of females to come into heat within a predictable time frame. It has been suggested that pheromones from the male lead to the increase in these hormone secretions, thereby inducing estrus or ovulation during the breeding season. However, during the nonbreeding season, the male effect is less likely to work on its own and is more effective in conjunction with a form of progesterone.

Reproductive Technology

Artificial Insemination (AI)

Advanced reproductive techniques such as artificial insemination provide a means by which genetic material can be transferred between locations. In addition, AI also eliminates health concerns associated with the movement of live animals from one farm to the next. During AI, semen is deposited into the female reproductive tract with artificial techniques rather than by natural means. The primary advantage of this technique is that it permits the extensive use of outstanding sires to maximize genetic improvement. In addition, once the necessary equipment is acquired, frozen semen might be much less expensive than paying a breeding fee or buying expensive males. Semen is now more readily available from many high-quality males, although semen from some breeds is more available than from other breeds. It is possible to quickly improve the quality of a herd using this technique.

The success of any AI protocol depends to a large degree on the correct timing of insemination relative to heat and ovulation. Success is also dependent on the ability to efficiently collect and cryopreserve spermatozoa from quality males for use on females from generation to generation (figure 3). Two AI methods are currently used in the small ruminant industry. Cervical insemination (common in goats) involves deposition of sperm in the cervix, while the second method, laparoscopic insemination (common in sheep), involves the use of a laparoscope and manipulating probe to aid in depositing fresh or frozen-thawed sperm directly into the uterine horns. Conception rates using cervical and laparoscopic AI range from 40% to 80% during the breeding and nonbreeding season. To accommodate AI, females are first synchronized and then inseminated based on the AM/PM rule. That is, a female is inseminated 12 hours after being observed in estrus. North Carolina State University has developed a novel ovulation synchronization technique for meat goats, NC-Synch, which does not require the use of progesterone and allows for all females to be bred at the same time without the need for heat/estrus checks. For more

information about the NC-Synch research and protocol, please visit: <https://goats.extension.org/2019/08/estrus-synchronization-for-timed-artificial-insemination-in-goats/>. This protocol utilizes transcervical insemination whereby semen is deposited directly in the uterus and bypasses the cervix (figure 4).



Figure 3. Semen collection with an artificial vagina. (Reprinted with permission from Stephen Wildeus, 2009.)



Figure 4. Transcervical insemination in goats. (Reprinted with permission from Stephen Wildeus, 2015.)

The dairy cattle industry almost completely involves timed AI in its reproductive protocols and this has led to many improvements in genetics and consistency in the market. Similar results can be achieved if this technology becomes mainstream in the sheep and goat industries.

Research at Virginia State University has developed a simple vaginal AI (shot-in-the-dark) (figure 5) procedure for hair sheep, using fresh chilled semen, which provides acceptable pregnancy rates even when used on commercial farms (40%-60%) (Wildeus 2012; O'Brien and Wildeus 2019). This has the potential to expand the use of AI in small farm settings and allow the movement of germplasm readily between farms to expand available hair sheep genetics in many states.



Figure 5. Simple vaginal AI in sheep. (Reprinted with permission from Stephen Wildeus, 2009.)

Embryo Transfer

Embryo transfer (ET) is a reproductive technology that allows producers to obtain more offspring from males and females with high-quality genetics in a shorter time. Basically, embryos resulting from the mating (natural or AI) of males and super-ovulated donor females are surgically removed and then placed into the uterus of less-desirable recipient females. For ET to be successful in a herd/flock, intensive reproductive management and excellent record-keeping skills is required. Also, the cost-benefit ratio must be considered. The products (kids/lambs) must be highly marketable or of high genetic value to balance the costs associated with developing an ET program.

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- Wildeus, S. 2012. "Pregnancy Rates in Hair Sheep Ewes Following Vaginal Insemination with Fresh and Short-term Stored Liquid Semen." *Reproduction in Domestic Animals* 47 (Supplement 4): 422.

Additional Resource

- Wildeus, S. 1999. *Goat Reproduction*, an online instructional module. <http://www.luresext.edu/?q=content/goat-reproduction>.

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