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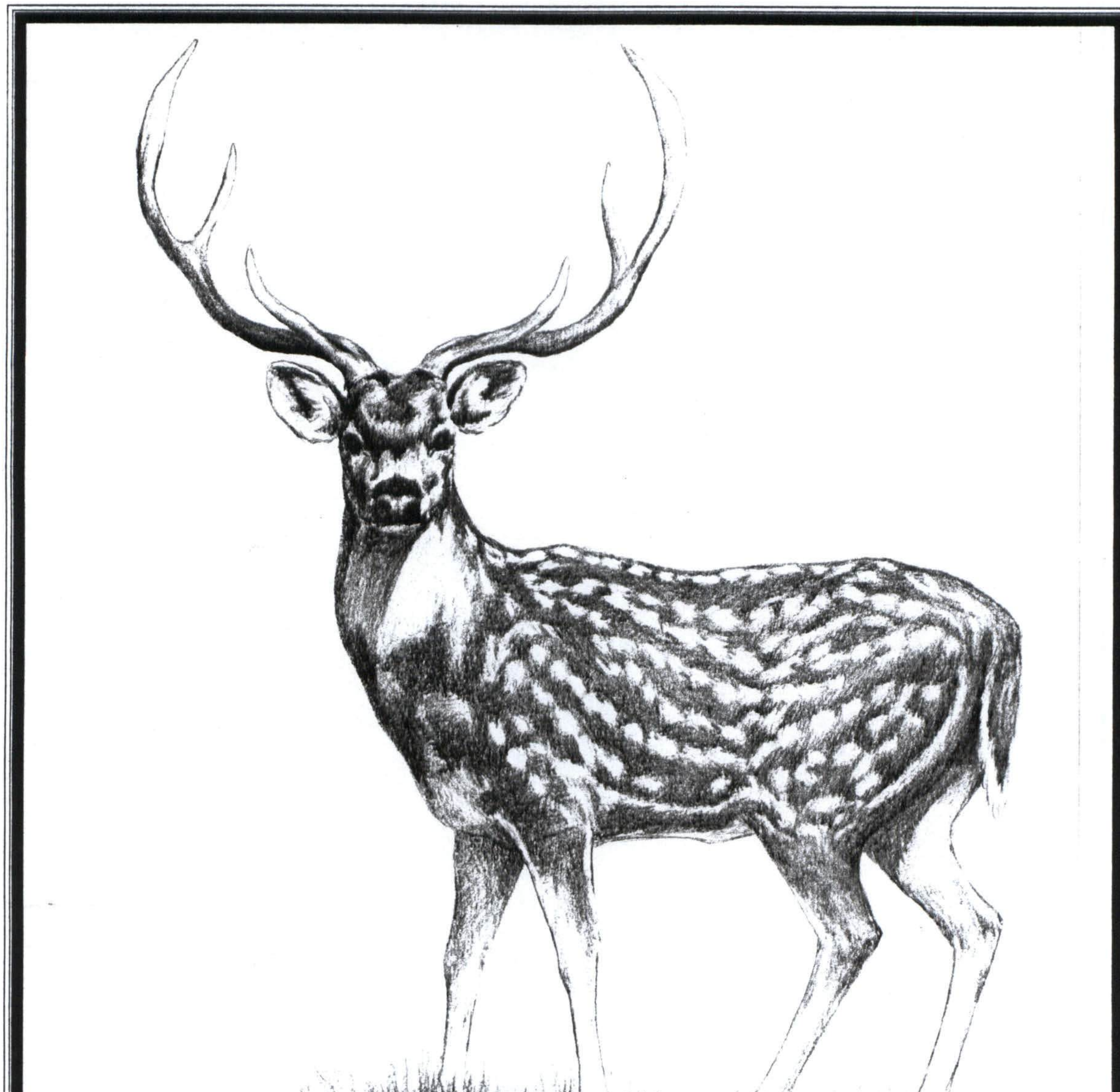

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CHAPTER 12

ESTROUS SYNCHRONIZATION AND ARTIFICIAL INSEMINATION OF DEER

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Background. The success of any livestock production system is influenced by key selection and management decisions on the part of the breeder. Historically, few of these have offered the potential of artificial insemination (AI). Development of a successful AI program requires a significant investment of both time and money. It offers production advantages over natural-service mating to those breeders who are willing to commit these resources.

Artificial insemination with fresh semen was first demonstrated in 1780 by the Italian physiologist, Spallanzani, in dogs. Ivanov began similar work with various species of livestock in turn-of-the century Russia. By 1938, techniques somewhat similar to those in use today were in development by cattle breeders in both the U.S. and northern Europe. The outcome of this early work was so successful that within a decade, many public and private organizations had formed for both dairy and beef cattle breeders. Within the last two decades, significant technical strides have been made in the usefulness of AI. It has become a basic tool, not only for domestic livestock producers, but also for the assistance of many threatened wildlife species worldwide.

Essentially, AI programs offer the ability to maximize the potential of the only two tools available to the breeder. Specifically these are: 1) genetic selection and 2) designed breeding systems. In general, AI involves artificially collecting semen from desirable males, subdividing it into amounts adequate for inducing conception and mechanically introducing it into the reproductive tract of the female at the appropriate time.

Even the most simple AI program requires a basic set of facilities and equipment and clear knowledge of their proper use. Because any AI program is essentially an interlocking series of consecutive steps, a single error, made consistently, can be disastrous to the outcome at fawning. It is our goal here to provide an overview of these topics as they apply to deer farming.

The traditional method used for AI of cattle is known as the rectocervical approach; because rectal palpation is not possible with the smaller species of deer, the recommended method here is called transcervical AI. This method is similar to that commonly used for AI in goats.

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Estrous Synchronization. Most managers will want to use estrous synchronization at the beginning of the breeding season. For the best results, a system based on a progestin should be used because it can cause estrous cycles to begin up to three weeks early. The most often utilized system employs an intravaginal progesterone releasing device, commonly known as the CIDR. This device is manufactured outside of the U.S. and is not currently approved for use by the Food and Drug Administration; therefore, availability is limited. The Syncro-Mate B system for estrous synchronization includes a norgestomet (synthetic progestin) ear implant manufactured in the U.S. and approved for use in cattle by the Food and Drug Administration. The norgestomet ear implant is therefore readily available.

We did a study making a direct comparison between the CIDR and half norgestomet ear implants (Syncro-Mate B, without the estrogen plus progestin injection) left in place for 14 days and found that sika hinds showed estrus at similar times (CIDR = 35 hours vs norgestomet 37 hours) with similar pregnancy rates (CIDR = 60% vs norgestomet = 67%). Time of onset of estrus was hastened in these sika hinds by treatment with 50 I.U. of intramuscular PMSG (pregnant mare serum gonadotropin). As the treatments were both working through the same mechanisms, they appear to be having the same results for estrous synchronization of deer. In a study in South Texas, we found that white-tailed deer treated with half norgestomet ear implants for 13 to 14 days were in estrus 58 hours after implant removal with 87% (26/30) showing estrus detected by fertile white-tailed bucks. From 75 to 90% of white-tailed does should show estrus following either CIDR or norgestomet treatment in an average of 58 hours from treatment removal. We treated red deer hinds with half norgestomet ear implants for 14 days and with 150 I.U. of intramuscular PMSG at implant removal. Standing estrus occurred at an average of 38 hours after implant removal (from 34 to 44 hours) in 80% of the hinds.

We find that while there are species differences in response time from device removal to estrus there is the same effectiveness of treatment using the half norgestomet ear implant for estrous synchronization in sika, white-tailed and red deer females with 79 to 90% of the females in estrus within a reasonable window for timed artificial insemination. Fertility is similar in females treated with either method of estrous synchronization. Our current recommendations are shown in table 1 below.

Table 1. Recommendations for estrous synchronization of Red, Sika and White-tailed deer.

Species	Duration of Progestin Treatment	Intramuscular PMSG Dose	Time for Insemination after Progestin Removal
Red Deer	12 to 14 days	150 I.U.*	48 to 52 h
Sika Deer	12 to 14 days	50 I.U.	48 to 52 h
White-tailed Deer	12 to 14 days	0	60 to 65 h

*International units.

The use of PMSG is not indicated for white-tailed deer as there is a risk of extreme ovulation rates (superovulation) in this species. Well-fed, white tailed does normally produce twins and triplets. The red deer and sika deer do not normally produce twins or triplets when treated with PMSG doses recommended here. However, higher doses of PMSG have been found to lower pregnancy rates in these species.

Estrous Synchronization with Natural Service: Estrous synchronization can also be combined with natural service breeding of pen-raised deer. Comparison of estrous synchronization combined with natural service relative to non-synchronized natural service in white-tailed deer shows fawns were born an average of 10 days earlier when does were estrous synchronized and bred by natural service. During the first 10 days of the fawning season, 68.6% of the fawns were born to the estrous-synchronized does compared with 18.8% of the fawns born to the non-synchronized does. These does were bred in individual groups of 10 does/buck and bucks achieved a 70% first-service conception rate in the estrous synchronized groups compared with 55% in the non-synchronized groups. Pregnancy rates for the entire breeding season were 83.3% in the estrous synchronized does and 70.0% in the non-synchronized does.

Artificial Insemination: There are two basic systems for artificial insemination of deer. Laparoscopic artificial insemination is accomplished by placing semen in each uterine horn in an anestheized doe. Transcervical artificial insemination is accomplished by passing an artificial insemination pipette through the cervix of a restrained doe. Willard et al. (1997) reported fertility was similar in sika does which were bred using laparoscopic or transcervical artificial insemination. Requirements for laparoscopic insemination include anesthesia of the doe and specialized laparoscopic equipment. Usually a veterinarian is required for anesthesia and a highly-skilled technician for insemination using the intra-abdominal laparoscope. Requirements for transcervical artificial insemination are facilities to retrain the doe, a light source, speculum and artificial insemination pipette. A technician familiar with semen handling and placement is required for transcervical artificial insemination. Anesthesia is not typically used in this 3 to 5 minute procedure.

Both techniques are effective in farmed deer species but require either estrus detection or synchronization of estrous with proper timing of insemination. Using estrous synchronization via half norgestomet ear implants, in the ear for 13 days, white-tailed does had a first service conception rate of 66.7% when inseminated transcervically about 65 hours after implant removal compared with estrous synchronized does bred natural service which had first-service conception rates of 70.0%.

Artificial insemination offers the ability of breeding several does with a single ejaculate and can allow a desirable buck to sire many more fawns in a breeding season compared with natural service breeding. Also, semen which is collected, extended and frozen can be stored indefinitely which can extend the breeder's ability to use the genetics of a superior buck for many years.

Transcervical Artificial Insemination Technique: Artificial insemination technicians can be selected and trained from available personnel or professional technicians can be hired in some areas. Because transcervical AI technique differs from the standard method if AI in cattle, some additional training and experience will likely be necessary for even highly experienced beef/dairy AI technicians. Training programs dealing with instruction in rectocervical (cattle) AI techniques are available, but these can vary greatly in quality, training intensity, and the specific recommendations. Such courses generally last three to five days; however, some organizations will provide on-farm instruction. It should be noted that most U.S. agricultural colleges devote an entire course to artificial insemination technique. Competence cannot be gained without significant experience, and even then, there is a large degree of variability in individual proficiency. Developing the skill to thread the insemination rod through the cervix should not be the only objective; high-quality programs emphasize the importance of proper semen handling technique, sanitation and development of the skills to consistently identify the proper site of semen deposition.

While there remains some controversy about the optimum site for semen deposition, at least two studies provide evidence that, in beef cattle, conception rates are highest when semen is deposited within the uterine body. Until specific information is available regarding farmed deer species, the cervico-uterine junction should be the target of semen deposition. Due to the lack of feedback otherwise provided by rectal palpation, limitations on self-evaluation of placement accuracy are higher with transcervical AI than with the rectocervical procedure. One study, which considered bovine rectocervical AI, reported considerable variation among inseminators in their ability to position the insemination rod correctly. Among all the technicians in this study, correct placements within the uterine body ranged from zero to 85% of the insemination attempts. These results and the fact that the uterine body in most cervids is less than one inch in length, suggest that consistently accurate semen deposition is a very difficult task. Successful AI technique requires a clear understanding of reproductive anatomy, mental concentration and attention to detail.

A stepwise outline of procedures for artificial insemination follows:

- The doe or hind is quietly retrained in the drop-floor cradle with the assistance of a second person.
- Thaw a single semen straw and <u>prepare the insemination gun</u>. Be sure to protect the semen straw from thermal shock until used. With the light source attached and a water-soluble lubricant applied, the speculum is inserted into the vulva at a slight upward angle. Using slight forward pressure and gentle turning side to side, advance the speculum until it reaches the cervical os. The os itself should be centered by sighting through the bore of the speculum.

- Gently insert the gun tip into the os cervix by sight. The anterior portion of the vagina, termed the fornix vagina, tends to stretch somewhat when the speculum or gun is pushed forward. This may give the false impression that the rod is advancing into the cervix, when it is actually above, below, or to either side of the os. With gentle side-to-side manipulation and slight forward pressure, the inseminator should generally be able to feel the rod pass through three cervical folds.
- The target for semen deposition, the uterine body, is the area between the internal cervical os and the internal uterine bifurcation, where the uterine horns begin to separate inside the reproductive tract. Accurate gun tip placement is probably the most difficult and important skill involved in transcervical AI. When the gun tip emerges from the internal os, the inseminator may be able to feel the entire rod slide somewhat freely back and forth within the reproductive tract. Depositing the semen in the cervix or randomly in the uterine horns will likely result in lower pregnancy rates.
- Once the gun tip is correctly positioned, deposit the semen. Semen deposition should take about five seconds. Slow delivery maximizes the amount of semen expelled from the straw.
- Be careful not to pull the insemination rod back through the cervix while the semen is being expelled.
- If the female has moved during semen deposition or the gun has moved, stop the semen deposition and correctly reposition it before continuing semen deposition.
- Slowly withdraw the AI gun, then the speculum. Release the female into a holding pen.