Physiology and reproductive techniques for whitetail deer

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Abstract

Purpose is to briefly explain the physiology of whitetail deer and to cover reproductive management and artificial insemination techniques. Also, to cover some more advanced reproductive technology such as embryo transfer and in vitro fertilization.

Keywords: Cervid, laparoscopic, transcervical, embryo

Introduction

The commercial farming of whitetail deer is a relatively recent agricultural enterprise that came about to supply trophy animals to the hunting preserve industry. Whitetail deer range over most of North and Central America and are the most hunted big game species in North America. As many as 30 subspecies have been identified, with 16 residing in the US. The 2 that are economically important to deer farming are *Odocoileus virginianus borealis* and *texanus*, the northern whitetail and the Texas whitetail respectively. These subspecies typically grow the largest antlers and in the case of northern whitetail deer, there is also an increase in body size. To help advance the propagation of better genetics, artificial insemination has been employed to use different genetics in areas where the movement of live deer is not allowed. This has given rise to a very profitable industry.

Physiology

Whitetail deer are seasonal breeders with rut brought on by decreasing day lengths. As the days begin to shorten from midsummer into fall, there is an increase in hormones in both males and females of the species. In males, this triggers the hardening of the antlers with rubbing to remove the velvet, an increase in size of the secondary sex glands and testes, and beginning of spermatogenesis. More aggressive rutting behaviors start appearing and the bachelor groups start sparring for dominance and eventually break up before the main rut occurs. Female will phase from the anestrous period and after a number of silent ovulations, will come into the first behavioral estrous cycle. Any female not bred in the first cycle will continue to cycle at 21 to 29 day intervals until pregnancy occurs or increasing day lengths bring anestrous phase.[1] Estrous cycle of the doe is very similar to that of other ruminant species, in that luteolysis of corpus luteum from the previous ovulation decreases in blood progesterone concentrations and increases i estradiol concentrations produced by maturing follicles. A surge in luteinizing hormone from the pituitary gland in response to estradiol ultimately induces ovulation,[2] and the cycle starts over. Timing of rut varies from region to region, sometimes up to 8 weeks, but deer from a particular region will maintain the timing of rut even if moved to another location. This is important to remember when planning the timing of breeding, as the northern deer tend to rut in late October to mid-November, whereas Texas deer will rut in late November through December. This can be manipulated somewhat; however, timing too far outside their normal time frame will adversely affect conception rates. Whitetail does are polyovulatory, with most mature does producing 1.6 - 1.8 offspring on average. Yearling does are more likely to produce single fawns.

Reproductive management and artificial insemination

Whitetail deer as a group are exceptionally fertile and respond well to manipulation of the cycle during natural rut. Many of the protocols used in other small ruminant species translate well to whitetail does. The most commonly estrus synchronization currently used in the industry is a 14 day CIDR protocol. A 0.3 g CIDR (Eazi-Breed CIDR Sheep Inserts™, Zoetis Animal Health, Parsippany, NJ) is inserted into the vagina on day 0 and removed on day 14, at which time PMSG or eCG is given to synchronize ovulation. Breeding should occur 54 - 62 hours after CIDR removal. Alternately, CIDR can

be left for 14 days, then removed without PMSG treatment; however, breeding should be delayed a few hours (60 - 64 hours). In our experience, this protocol produces substantially lower conception rates compared to PMSG use. In both protocols, GnRH is given at artificial insemination (AI) to induce ovulation.

Artificial insemination can be accomplished in 1 of 2 ways (transcervical or laparoscopy assisted). Transcervical AI is less technical of the 2 approaches and equipment involved is less expensive than that used with laparoscopic AI, thus making it a popular choice for some producers. The does are most often bred without sedation after being secured in a handling chute. A vaginal speculum is inserted and the external os cervix is located. Any mucus should be removed. A goat or cattle insemination pipette is then introduced through the os and manipulated through the rings of cervix to deposit semen just cranial to cervix in the body of uterus. The downfall of the procedure is that the rings of the cervix are difficult to manipulate, and depositing semen in the cervix will result in decreased conception rates overall. Conception rates vary but usually will average around 65%. For optimal conception after transcervical AI, 12 - 15 million progressively motile sperm are recommended. Technician experience and patience will greatly influence the outcome.

Laparoscopic AI is more technical and the equipment used is much more expensive than transcervical AI. The minimum equipment needed is a quality rigid laparoscope of sufficient length to allow the technician to comfortably observe the uterus, a surgical or AI cart capable of holding the animal in dorsal recumbency with the head down at approximately a 45 degree angle, a good light source, 1 trochar and 2 cannulas, a source of filtered air or carbon dioxide for insufflation, aspics, and other disposable items. The procedure starts with a surgical prep and scrub of the caudal abdomen adjacent to the mammary glands. Two stab incisions are then made with a number 15 blade through the linea, approximately 10 cm below the junction of the udder. Another incision is made 6 - 8 cm off the midline on either side. Filtered air or carbon dioxide are then introduced to sufficiently insufflate the abdomen to allow the trochar and cannula to be introduced without damaging internal organs in this area. Once the cannulas are in place, the laparoscope is introduced, as well as the aspic containing the semen. Semen is deposited by placing the needle of the aspic through the wall of the uterine horn into the lumen. Ideally semen should be deposited in distal third of uterine horn ipsilateral to the dominant follicle, or split between both uterine horns if the ovaries are not observed. By depositing semen closer to oviducts, less semen can be used (~6 - 8 million progressively motile sperm) and conception rates are generally 10 - 15% better than transcervical AI. Once the procedure is mastered it only takes a few minutes to perform. Complications include rupture of the bladder, rumen, or uterus with introduction of the trochar. These ruptures should be repaired immediately to prevent peritonitis.

Advance reproductive technology

More advanced reproductive procedures are also being used in whitetail deer. Multiple ovulation embryo transfer (MOET) has become increasingly popular in recent years as protocols have successfully been adapted to whitetail does. Embryo recovery rates average around 5.5 embryos per doe. A multi injection program utilizing porcine derived FSH has been successfully adapted. The dosage varies based on a number of criteria, but FSH is administered every 12 hours for 4 days, beginning 3 days prior to CIDR removal. There is also a new recombinant FSH that recently became available through compounding that is showing promise. The procedure for recovery of the embryos is the same as for ewes and other small ruminant species. Animal is anesthetized and placed in dorsal recumbency with the head down at approximately 30 degrees. Uterus is exteriorized and an appropriately sized foley is placed in the base of the uterine horn near uterine body. Then a tom cat catheter or 18 gauge, IV catheter is placed in the lumen near the tip of the horn and flushed retrograde with 50 - 60 ml of flush media into an embryo concentration filter or petri dish. Incisions into the uterus should be stitched in an inverting pattern to avoid adhesion formation, and care should be taken with handling the uterus as whitetail are extremely prone to scar formation. The body wall and skin are then closed and appropriate antibiotics are given prior to reversal of the anesthetic. Once recovered, embryos can be transferred within a few hours fresh, or frozen for storage. For implanting embryos, a laparoscope is used to identify the corpus luteum. The

embryo is then placed into a tom cat catheter and the catheter is used to deposit the embryo into the lumen of the uterine horn ipsilateral to the CL. As deer are polyovulatory, 2 embryos are usually placed per recipient. Implantation rates of fresh embryos in whitetail is exceptionally high, often ~90%. Implantation rate for frozen embryos decreases to ~65%.

In vitro fertilization is a technology that has made tremendous advancements in recent years in other ruminant species. There is currently some work being done with whitetails; however, its use is not commonplace.

Conflict of interest

There are no conflicts of interest to declare.

References

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