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The effect of equine chorionic gonadotropin (eCG) on pregnancy rates of white-tailed deer following fixed-timed artificial insemination

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Abstract

Control of the white-tailed doe's reproductive cycle is not well documented. The objective was to determine the effects of giving equine chorionic gonadotropin (eCG) at progesterone device removal on fixed time artificial insemination (FTAI) pregnancy rates in white-tailed does. All does (n = 74) were synchronized with a vaginal progesterone implant (CIDR; 0.3 g progesterone), inserted on Day 0 (without regard to stage of estrous cycle), removed 14 days later, and subjected to FTAI, on average, 60 h post-CIDR removal. Of these, 34 were given 200 IU (im) of eCG at CIDR removal. Overall, FTAI pregnancy rate was 50% across 2 yrs (effect of year, P = 0.35). Administration of eCG at CIDR removal did not affect (P = 0.16) pregnancy rate (eCG = 59%; no eCG = 43%). Pregnancy rates were not affected by vulva score or doe disposition. Does that were ≤ 4 yrs old were more likely (P = 0.01) to become pregnant than does > 4 yrs of age. Does inseminated ≥ 60.5 h after CIDR removal were 22 times more likely (P = 0.002) to become pregnant to FTAI than does inseminated < 60.5 h. When frozen-thawed semen was deposited in the cervix or uterus, does were 17 times more likely (P = 0.005) to become pregnant compared with those receiving intravaginal insemination. Fecundity was not different (P = 0.73) across treatment groups (1.6 ± 0.11; no eCG vs. 1.7 ± 0.10; eCG). Furthermore, fecundity of does pregnant to FTAI was not different (P = 0.72) compared with does pregnant to clean-up bucks (1.7 ± 0.08; AI does vs. 1.7 ± 0.09; clean-up bucks). In summary, white-tailed does were successfully inseminated using a 14 days FTAI protocol, eCG may not be essential for acceptable pregnancy rates, and increased pregnancy rates may result when FTAI is done ≥ 60.5 h after progesterone device removal.

Keywords: Fixed-timed AI; eCG; Estrus synchronization; Cervid; *Odocoileus virginianus*

1. Introduction

The popularity of white-tailed deer (*Odocoileus virginianus*) as a farmed species has increased dramatically over the last decade, with these operations now common throughout North America [1]. However, the physiological control of the white-tailed doe's repro-

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ductive cycle is not well documented. Clearly, a better understanding would enhance genetic improvement in breeding programs and new information could be utilized in assisted reproductive technologies for endangered cervids.

The goal at most white-tailed breeding facilities is production of large antler sets on breeding bucks which are used to assist in marketing cryopreserved semen. However, to utilize cryopreserved semen from genetically superior bucks in AI programs, development of successful, repeatable estrus synchronization protocols followed by fixed-timed AI (FTAI) is essential. Although FTAI has been incorporated into commercial beef and dairy operations, very few studies have reported FTAI protocols for white-tailed deer [2,3].

A protocol for FTAI of white-tailed does could be more easily and economically incorporated into the overall management of this species than protocols using either laparoscopic AI or a more traditional AI program using detection of estrus. Regarding the latter, since these animals do not exhibit homosexual mounting activity (in contrast to cattle), teaser animals combined with visual estrous detection would have to be employed. A successful FTAI program would yield pregnancy and subsequent fawning rates which are comparable to those produced by natural matings. Most FTAI protocols that have been successful in goats [4,5], sheep [6,7], cattle [8,9], fallow deer [10], wapiti [11], and red deer [12–14] have used a controlled internal drug-releasing device (CIDR) as a progesterone source. Equine chorionic gonadotropin (eCG) is routinely administered at CIDR removal in red deer to improve frequency and synchrony of ovulation, but has not been recommended for other cervidae, because of ovulation failure, multiple ovulations and reduced fertility [15,16]. Although there have apparently been no studies evaluating the effectiveness of eCG administration at CIDR removal in white-tailed does, our impression is that is commonly used in estrus synchronization protocols.

In our preliminary studies (unpublished), white-tailed does synchronized with an EAZI-BREED CIDR Sheep and Goat device for 14 days and transcervically inseminated 60 h post CIDR removal had similar pregnancy rates for chilled (60%) or frozen-thawed (57%) semen from the same buck. The fecundity rate for does pregnant to AI was 1.3 fawns per doe compared with 1.8 fawns per doe for those which subsequently became pregnant to natural service (clean-up bucks). Therefore, the objective of the present study was to evaluate the effects of a synchronization protocol utilizing a CIDR device, in conjunction with eCG, on pregnancy and fecundity rates of white-tailed deer following FTAI.

2. Materials and methods

2.1. Animals

This experiment was conducted at the Bob R. Jones Idlewild Research Station near Clinton, LA, USA (30°86′ N, 91°02′ W) and was replicated over two breeding seasons (late November or early December). Mature white-tailed does (Year 1: n = 36; Year 2: n = 38) used in this study were in good body condition with a mean age of 4.6 yrs (range: 2.5–8.5 yrs) and mean weight of 62.1 kg (range, 45–75 kg). Does were maintained on 20% deer pellets (Professional Sportsman's Choice Record Rack, Cargill Animal Nutrition, Minneapolis, MN, USA) and native grasses. Does were rotated among pens that ranged in size from 0.6 to 1.6 ha.

2.2. Experimental design

Each year, does were stratified by weight, age and last fawning date into two groups. Estrus synchronization protocols were then randomly assigned to each group. Thirty does were used both years; after stratification into groups and random assignment of treatment to groups, 18 does received the same treatment both years and 12 does received a different treatment across years. Also, six does were used in Year 1 that were not used in Year 2 and eight does were used in Year 2 that were not used in Year 1.

2.3. Estrus synchronization and fixed-timed artificial insemination

All does were synchronized with an EAZI-BREED CIDR Sheep and Goat device (0.3 g progesterone, Agtech Inc., Manhattan, KS, USA) on Day 0 and the CIDR remained in place for 14 days. Treatments consisted of estrus synchronization for FTAI (adapted from Schenk and DeGrofft [17]) to occur, on average, 60 h post-CIDR removal across all animals (no eCG: Year 1, n = 20; Year 2, n = 20) or 200 IU (im) injection of eCG (G4877, Sigma-Aldrich, St. Louis, MO, USA) at CIDR removal, followed by FTAI to occur on the average at 60 h post CIDR removal across all animals (eCG: Year 1, n = 16; Year 2, n = 18). The exact time of CIDR removal was recorded for each doe.

Does were inseminated with frozen-thawed semen (10×10^7 progressively motile sperm prefreeze) from a fertile buck that was collected via electroejaculation on-farm and frozen in 0.5-mL straws by a commercial