

Effects of seasonality on male white-tailed deer (*Odocoileus virginianus*) reproductive characteristics

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Introduction

The objective of this study was to evaluate reproductive characteristics of white-tailed deer (WTD) bucks early in the breeding season (SEPT), at peak rut (DEC), and late season (MAR). Deer farming is an emerging industry in the United States with dissemination of superior genetics relying on the ability to evaluate bucks and freeze semen. Despite cervid reproduction being strongly influenced by season, there is limited information available on how this affects semen quality, testicle size, or accessory sex glands in WTD.

Materials and Methods

Mature WTD bucks (n=7-11, mean age 2.6 ± 0.3 y) were anesthetized with tiletamine-zolazepam (0.4 mg/lb) and xylazine (1 mg/lb) administered intramuscularly by dart gun. All bucks were in hard antler at the time of first sample collection (SEPT), and all but 1 had dropped their antlers within a week of final sample collection (MAR). Semen was collected by electroejaculation and measured for total sperm output (volume \times concentration). Sperm motility was assessed using computer-automated sperm analysis. Sperm morphology of each sample was determined by evaluating 100 sperm cells at 1000 \times on a phase-contrast microscope. Scrotal circumference (SC) was measured using tape, and testicle measurements were obtained by ultrasound to calculate testicular volume ($V = 0.5236 \times L \times W^2$). Transrectal ultrasound was used to measure the length and width of the bulbourethral (BBG), vesicular (VG), and prostate glands. Sperm morphology was analyzed using a Kruskal-Wallis chi-squared test, and the remaining data were analyzed using ANOVA with repeated measures and Tukey post-hoc test in R. Data are expressed as mean \pm SEM.

Results

Total sperm output was 0.9 ± 0.2 bil (SEPT), 2.0 ± 0.6 bil (DEC), and 1.5 ± 0.3 bil (MAR) and did not differ between months ($P=0.15$). Overall (OM) and progressive (PM) sperm motility were decreased in MAR (OM: $45 \pm 4.4\%$; PM:

$32 \pm 4.9\%$) as compared to SEPT (OM: $71 \pm 4.4\%$; PM: $58 \pm 5.0\%$) and DEC (OM: $80 \pm 8.0\%$; PM: $75 \pm 8.7\%$; $P \leq 0.01$). The % normal sperm tended to be higher in DEC ($85 \pm 4.8\%$) than in SEPT ($63 \pm 7.8\%$) or MAR ($60 \pm 7.3\%$; $P \leq 0.06$), with less primary sperm defects also observed in DEC ($8.5 \pm 3.8\%$) compared to SEPT ($26.5 \pm 8.9\%$) or MAR ($21.4 \pm 5.1\%$; $P \leq 0.06$). There were no differences in % secondary sperm defects between SEPT ($10.9 \pm 2.4\%$), DEC ($6.6 \pm 3.1\%$), and MAR ($18.3 \pm 7.1\%$; $P=0.13$). Individual testicular volume was highest in SEPT (38 ± 4 cm³), intermediate in DEC (28 ± 2 cm³), and lowest in MAR (10 ± 1 cm³; $P < 0.01$). This was consistent with SC, which was largest in SEPT (19 ± 0.5 cm), intermediate in DEC (17 ± 0.3 cm), and smallest in MAR (14 ± 0.3 ; $P < 0.01$). Scrotal circumference was positively associated with testicular volume in both SEPT ($R=0.74$; $P=0.01$) and DEC ($R=0.74$; $P=0.04$) but had no correlation in MAR ($R=0.38$; $P=0.4$). Scrotal circumference was also positively associated with sperm output in SEPT ($R=0.62$; $P=0.04$) but had no correlation in DEC ($R=-0.12$; $P=0.8$) or MAR ($R=0.19$; $P=0.7$). The BBG were greater in length in MAR versus SEPT and DEC ($P \leq 0.05$), with no differences in width between months ($P=0.67$). Both VG length and width were highest in DEC, intermediate in SEPT, and lowest in MAR ($P \leq 0.02$). The prostate length was greatest in SEPT compared to DEC or MAR ($P \leq 0.02$), with no difference in width between months ($P=0.17$).

Significance

This project confirmed that there are significant differences in the reproductive characteristics of WTD bucks throughout the breeding season. Bucks have the best semen quality when in peak rut (DEC), which suggests that this is the best time to obtain semen for cryopreservation. Differences noted in accessory sex gland sizes throughout the season could be associated with changes in seminal plasma composition that may affect semen quality and should be critically evaluated in the future. The seasonal variations in parameters described here provide a useful guide for practitioners when evaluating breeding soundness in WTD bucks.