

PUBLICATIONS

2002

CONSUMING WHOLE COTTONSEED AFFECTS GROWTH AND REPRODUCTION OF MALE CERVIDS

C. G. Brown, D. A. Neuendorff, A. W. Lewis, R. D. Randel

Background. Many wildlife managers are providing whole cottonseed on a self-fed basis to both wild and ranched deer in Texas. They are using supplemental feeding of whole cottonseed from late summer through midwinter. This coincides with the breeding season of most native and exotic cervids. Gossypol is a toxic factor indigenous to the cotton plant genus *Gossypium*. Nonruminants are particularly sensitive to the toxic effects of gossypol, whereas ruminants are somewhat more resistant. Signs of gossypol toxicosis in nonruminants, preruminants and ruminants are similar and include labored breathing, dyspnea, decreased growth rate and anorexia but are not pathognomonic. The effects of gossypol on male ruminants are not easily detected by light microscopic evaluation of the ejaculate. Extensive damage to the germinal epithelium of ruminant males fed diets containing gossypol has been reported (Arshami and Ruttle, 1988,1989; Chase et al., 1994). Gossypol induces lesions to the midpiece of bull sperm, which are similar to those found in nonruminants. Structural weakness induced during spermatogenesis leads to secondary spermatozoal changes during extragonadal passage (Chenoweth et al., 2000). Specific mitochondrial damage in the tail of the spermatozoa and damage to sperm membranes have been reported in ruminant males consuming gossypol (Kramer et al., 1989; Chenoweth et al., 2000).

Research Findings. In this study, twelve fallow bucks aged 2 years and 12 yearling fallow bucks were randomly allocated into treatment groups adjusted for body weight (BW=57.73 kg) and age prior to beginning their antler growth period. Six bucks from each age group received whole cottonseed supplement (1.14% free gossypol, total gossypol 1.3%; analysis of kernel only) and 6 bucks received a cracked corn and soybean meal supplement calculated to be isoenergetic and isonitrogenous with the whole cottonseed supplement. The whole cottonseed group (WCS bucks) was fed *ad libitum* daily as much whole cottonseed as they would consume. Daily records were kept on the amount of whole cottonseed consumed. Maximum consumption of whole cottonseed for 2 yr. old bucks was 0.91 kg/head/day and 0.68 kg/head/day for 1 yr. old bucks. The animals were maintained on ryegrass/Coastal bermudagrass paddocks with free access to salt, minerals and water. When forage availability was limiting, alfalfa pellets were supplied as needed to maintain rumen function and health. Body weight (BW) and condition (BCS), right and left antler measurements, testicular measurements, scrotal circumference (SC) and blood samples via jugular venipuncture were collected at 28-day intervals throughout the antler growth

period. When antler growth ended and the bucks began to rub the velvet off of their antlers, ejaculates were collected by electroejaculation at 14-day intervals. After the bucks were in rut, semen samples were evaluated for concentration, morphology, and motility (including progressive motility). BW of control bucks were greater ($P < 0.08$) than WCS bucks from treatment day 160 until the end of the trial. BCS of control bucks was greater ($P < 0.0005$) than WCS bucks from treatment day 132 until the end of the trial. Total antler weight of WCS bucks (161.21 ± 32.54 g) was less ($P < 0.002$) than that of the control bucks (336.38 ± 32.54 g). Average antler length of WCS bucks (22.20 ± 3.58 cm) was less ($P < 0.02$) than control bucks (36.0 ± 3.58 cm). Antler density of WCS bucks (5.04 ± 0.83 g/cm) was less ($P < 0.07$) than control bucks (7.37 ± 0.83 g/cm). Maximum paired testis volume (Max PTV) was not different ($P > 0.1$) between treatments. Maximum sperm concentration in the ejaculate and the date of maximum sperm concentration in the ejaculate were not different ($P > 0.1$) between treatments. Maximum concentration of plasma testosterone was lower ($P < 0.003$) for WCS bucks (0.79 ± 0.14 ng/ml) than for control bucks (1.49 ± 0.14 ng/ml). Consumption of whole cottonseed resulted in lower ($P < 0.0001$) plasma testosterone throughout the sampling period. The maximum concentration of plasma testosterone was reached at an earlier date ($P < 0.04$) by WCS bucks (Julian date 223 ± 6 days) than by control bucks (Julian date 242 ± 6 days).

Application. Caution should be used by wildlife managers in the use of whole cottonseed as a self-fed supplement for either free ranging or captive cervids. These data indicate that either cervids are being affected negatively by gossypol intake or they are not capable of utilizing the increased fat in the diet provided by whole cottonseed. Cervids may not be able to utilize diets high in fat as effectively as true grazers that have a larger rumen with a slower ruminal turnover rate. Positive results of increasing fat in the diet of cattle and sheep may not apply to cervids.