AN EVALUATION OF A METHOD FOR REDUCING WHITE-TAILED DEER DEPREDATIONS ON SOYBEANS IN WESTERN TENNESSEE

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INTRODUCTION

The development of the Land-Between-The-Lakes Wildlife and Recreation Area (LBL) in western Tennessee and Kentucky by the Tennessee Valley Authority (TVA) has greatly increased the deer population level on that area. Tenant farmers on LBL report increasing crop losses due to deer depredations, and the area's wildlife managers are unable to maintain food plots for quail and other wildlife species because of deer damage.

LBL is one of the most popular deer hunting areas in the region. Approximately 25,570 hunters took advantage of the area's deer hunts last year, which are managed jointly by the TVA and the state wildlife agencies of Kentucky and Tennessee (D. Sharp, personal communication). The deer are also a major aesthetic attraction to the non-hunting public. Their status as a highly popular public resource precludes significant herd reductions, suggested by some (Baynes 1974, Bump 1949, Caslick and Decker 1977) as the best or most practical method of deer damage control.

Electric fences, advocated as effective means of deer damage reduction (Craven 1980, Palmer and Wingard 1982) are judged to be incompatible in the multiple-use public recreation program at LBL. Also, the nature of tenant farming there makes the use of such fences economically infeasible.

Deer repellents are the only other aversive methodologies which have had some measure of success in reducing deer depredations, and which may provide a viable solution to the deer damage problem at LBL. This 2-year, 2-part field evaluation of a repellent was conducted in response to the situations and problems inherent at LBL.

METHODS

Hinder (Leffingwell Chemical Co., a business of Uniroyal, Inc.), a commercially available repellent, was selected for this study on the basis of its EPA labeling for use in Kentucky and Tennessee on vegetable and field crops. It was the only appropriately labeled repellent available in commercial quantities at the time this study was initiated.

In 1982, four 2-ha soybean fields were used to determine Hinder's effectiveness in protecting commercial soybean fields from deer browsing. They are adjacent fields, separated into pairs by a larger (8-ha) field. One field received 2 regularly scheduled spray treatments at 1-week intervals commencing just after plant emergence with 3 resprays due to heavy rains. The border vegetation and outer 6 rows of beans were sprayed. Ventilated 1-gallon plastic jugs filled with a 1:4 Hinder-to-water mix were placed at approximately 100-foot intervals around the field's perimeter.

A second field received identically timed spray treatments to its border vegetation only, and plastic jugs were placed similarly to the first field. The jugs on both fields were refilled as needed due to evaporation. The second field in each pair acted as a control.

Two different fields were utilized for the commercial aspect of the study in 1983. A 1-ha field was divided in 2 parts with 1 part receiving weekly spray treatments (for 2 weeks, commencing just after plant emergence) to the outer 8 rows of soybeans; the other part served as a control. In a second 3-ha field, two .4-ha plots were established along a wooded field edge. One plot received spray treatment identical to that of the first field, the other served as a control. Plastic jugs were not used in 1983.

All fields in the commercial aspect of the study were inspected after each regularly scheduled treatment. Approximately 10% of the plants in each of the outer 6 rows were examined for deer damage and for measuring stem height.

A second aspect of the study utilized .004-ha plots, intended to simulate quail food plots planted to soybeans in a randomized-complete-block design. Distance between blocks ranged from approximately .2 km to 2.4 km. In 1982, 82 plots were distributed among 6 blocks. Experimental plots were treated twice, once at emergence and again 1 week later; remaining plots served as controls.

Ninety-two plots were established on the same 6 blocks in 1983. Experimental plots were treated at 2-day intervals for 4 weeks, untreated plots again serving as controls.

All plots were sampled weekly during the treatment period to determine the percent of plants browsed by deer and plant stem height.

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STUDY AREA

LBL, situated in western Kentucky and Tennessee between Lake Barkley (formerly the Cumberland River) to the east and Kentucky Lake (formerly the Tennessee River) to the west, encompasses about 68,800 ha. Approximately $\frac{1}{3}$ of the area is in Stewart County, Tennessee; the remaining $\frac{2}{3}$ are in Trigg and Lyon counties, Kentucky. Eighty-five percent LBL is wooded, with the remaining 15% in open lands. About 2,000 ha are actively farmed (D. Sharp, personal communication). Topography ranges from narrow creek bottoms to rolling hills. The climate is warm temperate (Austin et al. 1953).

The commercial soybean field studies were conducted in narrow creek bottoms that are surrounded by woods, on well-drained silt-loam soils. The food plots were established in old fields that were bordered by woods and maintained by occasional mowing. They were on slightly to severely eroded, well-drained cherty loam soils.

STUDY AREA DEER POPULATION

The deer population level was exceedingly low on LBL when it was created in 1964. No quantitative population estimates are available, but TVA deer-hunt records portray the dramatic increase in LBL deer numbers since the mid-1960's.

The first deer hunt on LBL was an archery hunt in the Kentucky portion only in 1965. Twenty deer were harvested. The first gun hunt was again in Kentucky only and 257 hunters harvested 30 deer. The first hunt in the Tennessee portion was a 2-day gun hunt in 1968. Four hundred twenty hunters took 24 deer (D. Sharp, personal communication).

By 1982, both portions of LBL had 9-day gun hunts. In Kentucky, 7,900 hunters took 710 deer, and in Tennessee, 5,270 hunters harvested 854 deer. The 52-day bow season (approximately 12,400 hunters participating in all) saw 244 and 369 deer taken in the Kentucky and Tennessee portions, respectively, for a grand total of 2,177 deer harvested (D. Sharp, personal communication).

The 1982 prehunt density was estimated to be 1 deer per 12-14 ha and 8-10 ha in the Kentucky and Tennessee portions, respectively, placing them in the highest density range of the region (D. Sharp, personal communication).

RESULTS

In 1982, neither plant height nor percentage of stems browsed in the commercial soybean fields were significantly different in treated vs. untreated fields. Deer did not browse any portion of either field used in 1983.

In the food plot study, plant height was greater ($p < 0.01$) on treated than on untreated plots for the first 3 weeks of growth in 1982 and the first 2 weeks in 1983. Untreated plant stems were typically only 2-4 cm. tall when all leaves and the stem tip were browsed by deer, killing the plant. Treated plants often reached 10-15 cm. before they were browsed by deer. Resprouting occurred regularly in the larger treated plants, but new leaves were browsed before plants could put on significant growth.

The percent of treated food plots damaged by deer was significantly lower ($p < 0.01$) than untreated plots during the same time period. In 1983, 98% of the untreated plots vs. about 22% of the treated plots were damaged or destroyed by deer during the first 2 weeks of growth. By week 4 of that same year, however, 100% of the treated plots had sustained heavy deer damage.

DISCUSSION

Hinder was effective in controlling deer damage to small soybean food plots only during initial stages of growth. Only 29.3% and 21.7% of the treated plots were damaged by deer at the end of the second week of growth in 1982 and 1983, respectively, compared to damage to 78% and 98% of the untreated plots for those same years.

In 1982, treatment was discontinued after the first 3 weeks of plant growth to see if plants on our study area could sustain browse injury after that time and still be productive, as indicated by deCalesta and Schwendeman (1978) and Flyger and Thoerig (1962). All our plots were destroyed by deer within one month following the last treatment with Hinder.

Treatment of the food plots was greatly intensified in 1983 to determine what application regime would be necessary, regardless of economic considerations, to produce a bean crop on the plots. In spite of the intensified treatments, 98% of the treated plots were severely damaged or destroyed by the end of the third week.

The fields utilized in the commercial aspect of our study were small and closely bordered by woods. Flyger and Thoerig (1962) and deCalesta and Schwendeman (1978) found that the fields with the greatest extent of wooded borders received the most deer damage during their studies in Maryland and

North Carolina, respectively. This field situation, in concert with the extremely high deer density on LBL, may have added significantly to Hinder's lack of effectiveness in the commercial field study, and to its week-by-week decrease in effectiveness on small food plots.

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