Evaluation of Deer Repellents for Reducing Deer Damage to Christmas Trees

Project Leaders

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Abstract

White-tailed deer (*Odocoileus virginianus*) populations are overabundant in many locations in New York State and the Northeast. In such areas, the costs of crop and landscape plant damage continue to rise. Growers and homeowners need reliable repellent products to protect their plant material from deer browsing damage. In past research, efficacy of commercial deer repellents was highly variable, and few products provided reliable protection beyond 4 to 6 weeks at a time when deer feeding pressure was high. We evaluated a new deer repellent (TRICO) registered in Europe that has shown promise for preventing deer damage to trees for up to 6 months with a single spray application. Lack of persistent snow cover, and an abundant fall mast crop, resulted in no deer damage to fir trees on three study farms because of alternative forage available. We did observe deer damage to Fraser fir trees (*Abies fraseri*) on a fourth farm. Both formulations of TRICO repellent tested, along with a commercial product (Plantskydd), prevented deer damage to Christmas trees on this farm for the entire winter. The control fir trees had an average of 9.5 twig tips missing per tree, compared with 0 twigs missing for any of the repellent-treated trees. Additional replicated field trials are warranted, as these results were very encouraging.

Background and Justification

Damage to ornamental flowers, shrubs, crops, nurseries, and orchards by white-tailed deer (Odocoileus virginianus) is substantial throughout many areas of North America (Drake et al., 2005). Economic losses caused by deer damage to landscape plants has been estimated at $6.4 million to $9.5 million annually in Westchester County, New York, alone (Connelly et al., 1987). Nationwide, the economic impacts attributed to deer have been estimated at $100 million and $251 million annually for the agriculture and urban sectors, respectively (Conover, 1997). In southeastern New York, nursery producers with deer damage spent an average of $20,000 annually, and homeowners spent an average of almost $500 for plant replacement costs in 1988 alone (Sayre and Decker, 1990).

Commercially available repellents have provided an acceptable level of plant protection (Andelt et al., 1991, 1994; Baker et al., 1999; El Hani and Conover, 1997; Lemieux et al., 2000) for some growers. Although several repellents are currently on the market, Deer-Away Big Game Repellent (McLaughlin Gormerly King, Minneapolis, MN), made from putrescent egg solids, appeared to be the most promising formulation in several field tests, reducing deer browsing by an average of 50% (El Hani and Conover, 1997; Wagner and Nolte, 2001, Curtis and Boulanger 2010). For many landowners, however, this level of protection remains unacceptable. Therefore, further research is needed to develop and evaluate novel, long-lasting deer repellents.

Food selection by herbivores is complex, and nutrient composition and palatability can have major influences on plant varieties consumed. In theory, repellents work by reducing the palatability of treated plants relative to other available forage (El Hani and Conover, 1997). Past research (Sayre and Decker, 1990) has shown that Fraser and balsam fir (*Abies balsamea*) are the Christmas tree varieties most susceptible to deer feeding damage. Therefore, we tested two formulations of TRICO deer repellent on commercial Christmas tree farms with a history of deer damage that are growing these tree varieties.

Objectives

We evaluated the effectiveness of TRICO deer repellent (Kwizda Agro GmbH, 1010 Wien, Universitätsring 6 Österreich) for reducing white-tailed deer damage to commercial Christmas tree plantings. In order to better understand the repellent efficacy and longevity of this novel repellent, we studied:

1. Two formulations (U.S. and E.U. mixes) of TRICO deer repellent,
2. Relative efficacy of TRICO repellent as compared to another commercial product (Plantskydd) and control (untreated) trees, and
3. Deer damage to fir trees (*Abies fraseri*) for 5 months (fall through spring), during times when deer feeding on woody trees and buds is usually most severe.

Methods

The study took place on four commercial Christmas tree farms with a history of deer damage and feeding pressure. Two farms (Grezenda and Stokoe) were in the Rochester area, one farm (Wiles) was located just south of Syracuse, and the fourth farm (Fetzer) was located near Olean, New York. All study farms had young fir trees (approximately 1 m in height) accessible to deer feeding, and prior deer damage to trees was observed during field scouting.

During late October 2019, we tagged 20 trees in each of four groups (TRICO US formulation, TRICO EU formulation, Plantskydd, and control). This required 80 fir trees of the appropriate age on each of the four farms, for a total of 320 trees in the experiment. Each study tree was tagged with numbered, colored flagging, with a different tag color for each treatment. Trees were sprayed with a backpack sprayer following label instructions during late October/November 2019. We assessed ease of use for each product, along with any residual odors.

Plots were installed on the Grezenda and Stokoe Farms on 23 October, the Wiles Farm on 24 October, and the Fetzer Farm on 25 November 2019 (Figure 1). Baseline photographs were taken

of all trees with a digital camera during Week 0 on the first day of trial at each farm (Figure 2). Deer damage was evaluated monthly (19 November, 24 December, 24 January, 21 February, and 31 March) on the first three farms. On the Fetzer Farm, deer damage was only recorded at the beginning (25 November) and end of the trial (14 April) because of field access issues during winter and driving distances. We compared deer browsing damage on repellent-treated vs. non-treated Fraser fir trees.

Photographs of damaged trees were downloaded onto a computer for analysis with scanning software. A white board was used as a reference background for each tree. A consistent distance from the tree to the camera was maintained at 2 m, and a tripod was used to keep the camera at the same height above the ground for all photographs. We also noted any evidence of recent deer tracks and droppings near the plots. A trail camera (Cuddeback Non-Typical Inc, Green Bay, WI, United States; X-Change™ Color model 1279) with shutter set to width FULL, flash at medium, and focus at medium, was installed to document deer presence and behavior at all plots except for the Fetzer farm.

Counts of deer-browsed limbs were made on each fir tree damaged during the study. Photographs were also taken to determine the surface area removed from each tree. In pending analyses, photographs will be cropped to only the surface area of the tree outline defined by intensity (darkness). We then will attempt to estimate percent loss of the canopy area to the nearest 5% level.

Results and Discussion

There was no deer damage observed to fir trees on the Grezenda, Stokoe, or Wiles farms during winter 2019 to 2020. We only observed deer damage to fir trees on the Fetzer farm. Weather and other factors experienced during the past winter were very unusual. First, there was an abundant natural mast crop in fall 2019, so there were plenty of red oak (Quercus rubra) acorns and apples (Malus spp.) available for deer to feed on, well into the winter months. Deer were frequently observed in and around the Christmas tree plantings (Figure 3), but they were not forced to feed on the trees.

Instead, the deer foraged on alternative foods nearby. More palatable grasses, mast, and crops were available during almost the entire winter, which was very unusual for Upstate New York.

This winter was very mild near Syracuse and Rochester, with above average temperatures and below average snowfall (Lawrimore et al. 2016). The reported 10-year averages for snowfall in Syracuse were 32 days with measurable snow, averaging 119.6 inches (303.8 cm) for the winter months. In 2020, Syracuse only had 87.6 total inches (222.5 cm) of snow, 32 inches (81.3 cm) below the 10-year average. Also, with warmer than average temperatures, the snow did not persist on the ground, and there were no major storms.

The situation was similar for Rochester. The reported 10-year averages for snowfall in Rochester were 27 days with measurable snow, averaging 97.5 inches (248 cm) for the winter months. In 2020, Rochester only had 65.8 inches (167.1 cm) of snow during December through February, 5.7 inches (14.5 cm) below average. With the lack of deep, persistent layer of snow, deer were able to forage on mast, agricultural crops, and grasses throughout the winter months in 2019-

2020. They were not forced to feed on fir trees or other woody browse during winter, which has occurred most years.

Farther south from Lake Ontario, and at higher elevation, there was more persistent snowfall at the Fetzer farm during winter. Based on numerical counts of missing branch tips, none of the study fir trees treated with repellents experienced detectable damage from deer browsing. However, the control (untreated) fir trees had an average of 9.5 twig tips missing per tree (Figures 4 and Figure 5). Therefore, both formulations (EU and US) of the TRICO deer repellent prevented deer damage to Christmas trees for the entire winter on this farm. They performed similar to the commercial deer repellent Plantskydd during this trial.

The data we collected showed that Christmas trees (Fraser firs) treated with TRICO deer repellent formulations experienced no deer browsing, compared to heavy damage to control trees, on one farm during late October through spring green-up in mid-April. Unfortunately given unusual environmental factors (abundant mast, lack of persistent snow), we did not observe deer damage to fir trees at the other three farms during winter 2019-2020. Although these initial results for the TRICO deer repellents were very encouraging, additional replicated field trials are warranted. It would also be interesting to treat landscape ornamental plants such as Japanese yews (*Taxus cuspidata*) during winter, as these evergreen shrubs are highly preferred forage plants for deer in winter.

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Photo Documentation

Figure 1. B. Eshenaur spraying fir trees with TRICO deer repellent at the Stokoe Farm on 23 October 2019.

Figure 2. Taking digital photos of tagged fir trees against the white board at the Stokoe Farm on 23 October 2019.

Figure 3. Deer feeding on grasses adjacent to the Christmas trees at the Grzenda Farm on 22 March 2020.

Figure 4. Control fir tree C1 on the Fetzer farm at the beginning of the trial on 25 November 2019

Figure 5. Deer damage to control fir tree C1 on the Fetzer farm at the end of the repellent trial on 14 April 2020. Note change in form and several missing branch tips this sample photograph was typical of all trees in the control treatment.