Tree Planter's Notes, Vol. 46, No. 1 (1995)

Effectiveness of BGR-P and Garlic in Inhibiting Browsing of Western Redcedar by Black-Tailed Deer

Dale L. Nolte, James P. Farley, and Sandi Holbrook

Research wildlife biologist and biological technician, USDA Animal and Plant Health Inspection Service, Denver Wildlife Research Center, Olympia, Washington; and forestry technician, USDA Forest Service, Payette National Forest, McCall, Idaho

Repellents may offer a feasible approach to alleviating browsing damage by herbivores. We evaluated the effectiveness of Big Game Repellent-Powder® (BGR-P) and garlic in inhibiting browsing by black-tailed deer (Odocoileus hemionus) *on western redcedar* (Thuja plicata *Donn ex D. Don.). Seedlings were examined for browsing damage at 24 and 48 hours after treatment and then at 1week intervals for 10 weeks. Seedlings treated with BGR-P suffered less damage than did seedlings treated with garlic or untreated seedlings for the first 8 weeks of the study. The garlic treatment reduced damage below that incurred by untreated seedlings for only 48 hours. BGR-P provides a feasible approach to inhibiting browsing damage for short time spans. The garlic treatment provided marginal protection in these tests but might be worthwhile for other, less desirable tree species.* Tree Planters' Notes 46(1):46; 1995.

Elk and deer browsing of tree seedlings (figure 1) seriously hinders reforestation efforts in the Pacific Northwest (Rochelle 1992). Browsing suppresses growth and delays regeneration, as well as killing many seedlings that are repeatedly browsed or pulled out of the ground (Evans 1987). Repellents may offer a feasible approach to inhibiting browsing, particularly in areas where the damage is inflicted by migrating herds and the seedlings are only subjected to browsing for a short, clearly defined period.

Figure 1—*Black-tailed deer browsing western redcedar treated with garlic capsules.*

In the present experiment, we evaluated the effectiveness of Big Game Repellent-Powder® (BGR-P) and garlic in inhibiting black-tailed deer *(Odocoileus hemionus)* browsing of western redcedar *(Thuja plicata* Donn ex D. Don.). Although the available data suggested that either product can temporarily deter some ungulates, their effectiveness in protecting western redcedar from browsing deer was largely unknown.

Materials and Methods

Subjects. A resident herd of 8 adult black-tailed deer served as subjects. Deer were group-enclosed in an area (4 ha) that was reflective of natural habitat consisting of Douglas-fir *(Pseudotsuga menziesii* (Mirb.) Franco) and alder *(Alnus* spp.*)* and associated understory vegetation. Although natural forage was readily available, animals were also provided free access to deer pellets and water throughout the study.

Repellents. BGR-P was donated by IntAgra (Minneapolis, MN) and the test garlic product was donated by Plant Pro-Tech, Inc. (Oak Run, CA). Repellents were applied according to the label or directions provided with each product. BGR-P-treated trees were first sprayed with water and then sprinkled with BGR-P. A Plant Pro-Tech (garlic) capsule was affixed to the terminal branch of each seedling as per directions. Control seedlings were sprayed with water.

Procedure. Immediately before the trial (April 4, 1994), 6 blocks of 3 plots each were established in the deer enclosure. Each plot contained 9 redcedar seedlings (mean height of 85 cm) planted in 3 rows of 3 trees at 2-m spacings. Plots within a block were separated by 25 m, and blocks were spaced at a minimum of 75 m apart. One plot within each block was randomly selected for each one of the treatments (BGR-P, garlic, or control) as described above.

Seedlings were examined for browsing damage at 24 and 48 hours after treatment and then at 1-week intervals for 10 weeks. Four weeks after the beginning of the study, the number of blocks assessed for damage was reduced to 4 because deer were excluded from the portion of the enclosure that contained the other 2 blocks. During damage evaluations, each seedling was examined to determine whether the terminal branch had been clipped and to count the number of bites taken from lateral branches. Bite counts were limited to a maximum of 25, because after 25 bites the seedlings were essentially defoliated. Generally, browsing damage consisted of either only a few bites from lateral foliage or complete defoliation. Regardless, the evaluation criteria were consistent among treatments and provided an accurate assessment to evaluate:

- The number of undamaged seedlings
- The number of seedlings with terminal damage
- The mean number of lateral bites taken
- The number of completely defoliated seedlings (25 bites)

Though these evaluation measures are interrelated, we report all 4 criteria because they are indicative of different levels of damage intensity.

Analysis. Chi-square goodness-of-fit tests were used to assess differences among treatments. Observed values were the summation of data across blocks for the respective treatments. A separate analysis was conducted for each evaluation criterion.

Results

A greater number of seedlings treated with BGR-P remained undamaged for the first 8 weeks of the study than did seedlings treated with garlic or control seedlings (figure 2). During the first 48 hours, garlic provided better protection than no treatment. Similar time intervals occurred when damage was assessed by the number of completely defoliated trees for each treatment (figure 3). More terminal branches escaped damage on seedlings treated with BGR-P than did garlic-treated seedlings or control seedlings for 6 weeks (figure 4). Again, seedlings treated with garlic fared better than the untreated seedlings for the first 48 hours of the study. A similar number of lateral bites were counted on seedlings treated with garlic or untreated seedlings throughout the study, but fewer bites were taken from BGRP-treated seedlings until week 7 (figure 5).

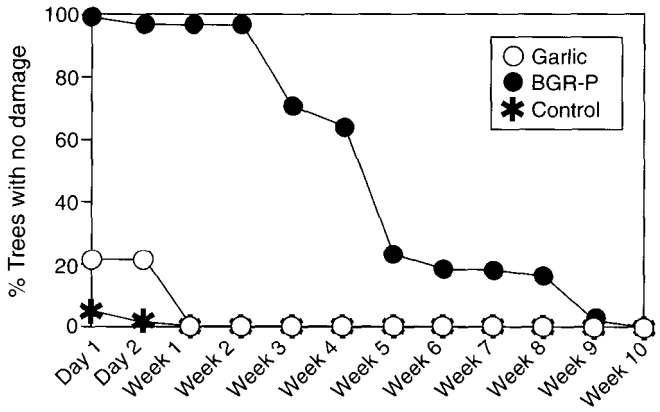

Figure 2—Percentage of seedlings treated with garlic or BGR-P or untreated that remained undamaged for each evaluation period.

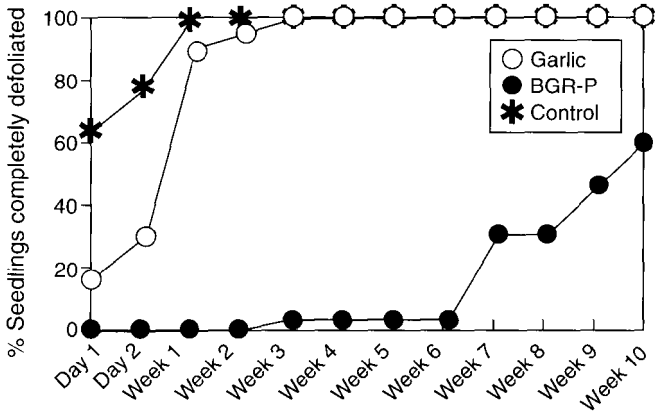

Figure 3—Percentage of seedlings treated with garlic or BGR-P or untreated that were completely defoliated (≥ 25 bites) for each evaluation period.

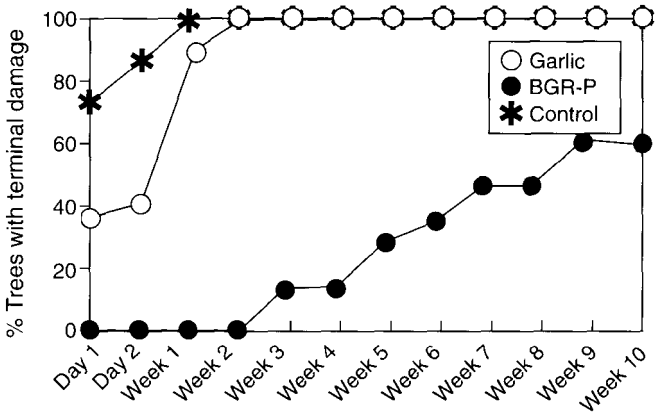

Figure 4—Percentage of seedlings treated with garlic or BGR-P or untreated that sustained damage to their terminal branch for each evaluation period.

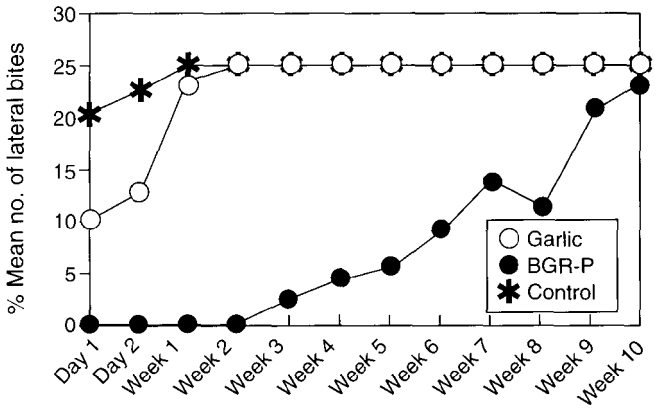

***Figure 5**—Mean number of bites taken from the lateral branches of seedlings treated with garlic or BGR-P or untreated for each evaluation period.*

Discussion

Forage selection is relative and depends on the available options. An animal may select one food over another either because it is attracted to the first or because it is avoiding the alternative (Galef 1985). Thus, the efficacy of a repellent depends on the desirability of the plant to be protected as well as the availability and palatability of the surrounding forage. A preferred plant in a barren environment is far more difficult to protect than an unpalatable shrub amongst lush forage.

Experimental conditions of this study provided the deer with a variety of alternative choices. Browse was readily available along with *ad libitum* access to deer pellets. Though the deer were not food-deprived, the test food–western redcedar— is a preferred forage. These conditions are similar to many field situations where repellents may be applicable, for example, reforestation sites where palatable tree seedlings are vulnerable to browsing herbivores that have alternative foraging opportunities.

BGR-P virtually eliminated damage for 2 weeks after treatment, and the deer inflicted substantially less damage to BGR-P-treated trees than to control trees during the first 8 weeks of the study. These results compare favorably with those found in other studies (Conover 1984, Harris and others 1993, Palmer and others 1983, Andelt and others 1991 and 1992). However, avoidance of garlic-treated seedlings was brief. Other studies indicate that garlic deters foraging herbivores only as long as other options are readily available (Nolte and others 1992). An operational application of garlic capsules to ponderosa pine *(Pinus ponderosa* Dougl. ex Laws.) also failed to produce favorable results. None of the 2,000 ponderosa pines treated with garlic escaped damage from winter browsing by elk (Sigrist, personal communication). Trees are long-lived, and browsing damage is difficult to prevent completely. No repellent is likely to provide total protection. Nevertheless, repellents can reduce damage during periods when trees are most vulnerable. Use of BGR-P is a feasible approach to protecting seedlings when they are first outplanted or during seasons when damage is most likely to occur only briefly, at known times. Garlic was only marginally effective under our test conditions, but it may be more successful in protecting less preferred plant species.

Address correspondence to Dale Nolte, USDA/APHIS/DWRC, 9701 Blomberg Street SW, Olympia, WA 98512.

Literature Cited

Andelt WE, Burnham KP, Manning JA. 1991. Relative effectiveness of repellents for reducing mule deer damage. Journal of Wildlife Management 55:341-347.

Andelt WE, Baker DL, Burnham KP. 1992. Relative preference of captive cow elk for repellent-treated diets. Journal of Wildlife Management 56:164-173.

Conover MR. 1984. Effectiveness of repellents in reducing deer damage in nurseries. Wildlife Society Bulletin 12:399-404.

Evans J. 1987. Animal damage and its control in ponderosa pine forests. In: Baumgartner DM, Lotan JE, eds. Proceedings, Ponderosa pine: the species and its management; Spokane, Washington. p 109-114

Galef BG. 1985. Direct and indirect behavioral pathways to the social transmission of food avoidance. In: Braveman NS, Bronstein P, eds. Experimental assessments and clinical applications of conditioned food aversions. New York: New York Academy of Sciences. p 203-215

Harris MT, Palmer WL, George JL. 1983. Preliminary screening of white-tailed deer repellents. Journal of Wildlife Management 47:516-519.

Nolte DL, Provenza FD, Balph DF. 1992. Food preferences in lambs after exposure to flavors in solid foods. Applied Animal Behavioral Science 32:337-347.

Palmer WL, Wingard RG, George JL. 1983. Evaluation of whitetailed deer repellents. Wildlife Society Bulletin 11:164-166.

Rochelle JA. 1992. Deer and elk. In: Black HC, ed. Silvicultural approaches to animal damage management in Pacific Northwest forests. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. p 333-349.