Repellents are Socially Acceptable Tools

BY DALE L. NOLTE

The likelihood of a particular plant being consumed by an animal depends on its palatability, along with the availability and relative desirability of alternative foods. Repellents, therefore, can be applied to plants to render them less attractive than the alternative foods. In theory, animals then select for plants or foraging areas other than those protected with repellents. Repellents are socially acceptable nonlethal tools to reduce wildlife damage. New products are continually entering the market, but their efficacy varies greatly. Unfortunately, availability or even registration of these products does not equate to effectiveness. Some repellents contain aversive agents at concentrations below avoidance thresholds. Others may contain active ingredients to which the offending animal is indifferent.

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Deer in plots to assess the effectiveness of repellents.

Types of repellents

Repellents may be incorporated into the plant (systemic delivery), permitted to permeate an area (odor delivery) or applied directly to a plant (contact delivery).

Systemic repellents are compounds absorbed then translocated throughout the plant, rendering the foliage less desirable. Systemic delivery is ideal because compounds contained within the plant cannot be washed off and aversive agents are moved to new foliage as the plant grows. Unfortunately, few, if any products have effectively incorporated systemic repellents into a plant at concentrations that did not harm the plant.

Area repellents are products that create a chemical barrier that animals will not cross, or products that permeate an area with an odor, rendering it undesirable and avoided by animals. Several products continue to be marketed as containing offensive odors that deter deer for various distances. However, outside of anecdotal evidence or testimonials, there is no evidence suggesting efficacy of odor delivery. Scientists at the Olympia Field Station assessed products advertised as "odor" repellents and determined one of the products repelled all deer at any distance. Further, the greatest mean distance avoided for most products was less than three inches and no product was effective at a distance greater than a yard.

Contact repellents are products topically applied or attached directly to a plant. If the goal is to reduce consumption of plants, available evidence suggests that chemical repellents are most effective when they are applied directly to a plant.

NWRC Olympia Field Station scientists conducted a series of studies to compare efficacy of commercially available deer repellents. These products represented various active ingredients with different modes of action, such as "fear"-aversive conditioning, pain and taste.

Fear-inducing repellents contain degrading proteins that emit sulfurous odors, such as whole egg solids or animal by-products. Our tests demonstrated that generally the most effective products were those containing active ingredients (e.g., animal proteins) that produced sulfurous odors. However, not all repellents with sulfurous odors are effective in deterring deer for extended periods (greater than 12 weeks).

Conditioned avoidance occurs when ingestion of a food is paired with nausea or gastrointestinal distress. Animals generally restrict their intake of a food if it is associated with illness. Efficacy of repellents based on conditioned aversions, however, is generally limited because animals must be trained to avoid these mate-

rials. Therefore, damage inflicted on seedlings during training or subsequent sampling can be extensive. The use of conditioned-based repellents is especially problematic if the damage is inflicted by a transitory or migratory species such as elk.

Active ingredients such as capsaicin, allyl isothiocyanate and ammonia cause pain or irritation when they contact trigeminal receptors in the mucous membranes of the mouth, eyes, nose and gut. An inherent problem with using pain-inducing repellents is that they are universally aversive to all mammals. Few commercial repellents have effectively incorporated trigeminal irritants as active ingredients. Most likely, current repellents that depend on pain to induce avoidance are ineffective because the active ingredient is present at an inadequate concentration.

Bittering agents are often used to induce a **bad taste**. Unfortunately, while omnivores normally avoid bitter taste, herbivores are generally indifferent, at least at the concentrations used in most repellents.

Repellency is always relative and thus, always susceptible to failure. Many factors other than aversive properties impact the efficacy of a repellent to reduce damage.

Ultimately, avoidance of the protected plant is affected by 1) the number and density of animals inflicting problems; 2) mobility of the problem animals; 3) prior experience of animals with foods and familiarity with surroundings; 4) accessibility of alternative sites; 5) the availability of alternative foods in relation to treated plants; 6) the palatability of the treated commodity relative to alternative food; and 7) weather conditions.

Materials with good efficacy demonstrated under stringent conditions, such as protecting a highly palatable plant in the midst of dense animal populations with few alternative foods, in all probability will be effective under less stringent conditions. However, the reverse is rarely true, thus it is difficult for someone to predict the efficacy of repellents in the field by extrapolating from empirical data, and more worrisome to take even truthful anecdotal or testimonial evidence as indicators of repellent performance.

At present, few repellents are available that effectively deter deer browsing. The most effective repellents generally are topically applied proteins protecting plants for approximately three months depending on weather conditions. Some reduced efficacy may continue beyond this period, but there is generally a continued decline. We have not worked with any repellent that has demonstrated the ability to protect plants for six months. ◆

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Looking for More Information on Wildlife Damage?

The National Wildlife Research Center's Olympia Field Station and Western Forestry and Conservation Association will be sponsoring a conference next spring on wildlife damage management for foresters. Topics will include an overview of animal damage controls and management tools for specific species. The Olympia Field Station will also host a field demonstration of wildlife damage to assist forest managers in identifying damage on timberlands.

To get on the mailing list to receive more information, send a note to Richard Zabel at richard@westernforestry.org.

Oregon Timberland Ownership Data Available

Executives, managers and appraisers frequently need the ability to print professional quality timber ownership maps for reports and presentations. Unless they have been proficient with a GIS system, they have had to rely on someone else or another department to provide the maps. Fortunately, the technology and the data are now available for anyone to print their own maps.

Atterbury Consultants, Inc. has developed a data set of timberland ownership for all of Oregon. It is available in ArcReader format, allowing users to print ownership maps of the entire state or any portion of it. The data includes the top 30 private timberland owners in Oregon, plus state and federal ownership by agency. It also includes all sections, townships and county boundaries, as well as major highways and cities.

This data set includes the ESRI ArcReader software at no charge. This software allows the user to print maps at any scale. Data layers can be turned on and off. Executives and non-GIS users will find the ownership data and software very helpful in making professional looking maps for reports and presentations. Maps can be printed in portrait or landscape mode. They can also be easily exported in Microsoft Word format for easy insertion into reports.

The Atterbury Ownership Data Set comes in an ArcReader Published Map File (PMF) format. Users have unlimited ability to print maps but may not change the map data itself.

For more information, contact Jon Aschenbach at 503-646-5393 or jaschenbach@atterbury.com. The ArcReader program is also available by downloading free of charge from Atterbury Consultants at www.atterbury.com. The introductory price for the Oregon Timberland Ownership data set is $395.00. ◆