

REPELLENTS FOR PROTECTION OF YOUNG FOREST TREES FROM RABBIT AND RODENT DAMAGE

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Rabbit and rodent damage is the limiting factor in establishing many plantations of young forest trees. Shooting, trapping, and poisoning are methods of eliminating the animals involved, but it is frequently more practical to control the damage than to control the animal numbers. Treatment with chemical repellents is a damage-reduction procedure, and generally provides young trees excellent protection from rabbit and rodent attacks.

A repellent-screening program by the Denver and Patuxent Wildlife Research Centers, in which approximately 8,000 chemicals were tested, has resulted in the development of four formulations into commercial products. The three active ingredients in these products are trinitrobenzene-aniline (TNB-A), tetramethyl thiuram disulfide (TMTD), and zinc dimethyldithiocarbamate cyclohexylamine complex (ZAC).

The TNB-A is formulated in an organic solvent and can be applied in freezing temperatures, but it is toxic to conifers and growing hardwoods. The TMTD and ZAC products are water dispersible concentrates that are diluted before use, the dilution rate depending upon the kind and severity of animal damage in the plantation. These repellents must be applied when temperatures are above freezing.

The films of all four products are unusually resistant to rain, snow, sun, and freezing temperatures. Protection is usually provided from fall to spring, and repellency has even been noted the second dormant season. New growth from treated terminals is not protected, but this is less of a handicap with rabbits and rodents which feed on lower parts of the plant than with deer and other large herbivores which feed on the terminal and lateral growth. Annual treatment is required for very small trees, regardless of the animal involved.

Retail costs of the commercial repellent concentrates range from \$8 to \$11 per gallon; governmental agencies are usually given dealer prices which are approximately 20 percent less. Recommended dilution rates reduce the costs to economical levels. As an example, when treatment is made in the nursery, good protection from rabbits is afforded Douglasfir seedlings in the Pacific Northwest at a cost of less than one dollar per thousand.

The components of the three water-based repellents can be purchased separately and mixed by the consumer. The resulting sprays will approach the manufactured formulations in effectiveness and will cost approximately two-thirds less. This practice is not recommended, however, unless 5 gallons or more are prepared, because the additional labor and problems encountered will preclude any savings. The components in the TNB-A product cannot be purchased separately.

Repellents for Rabbits

High concentrations of any one of the four repellents will provide excellent protection from rabbits (Sylvilagus and Lepus) to trees which are too large to be severed in a single bite, generally those more than one-half inch in diameter. TNB-A is usually rated the most active rabbit repellent available, but it is also the most expensive. The TMTD

formulations are also highly effective for rabbits, while ZAC, an excellent deer repellent, is slightly less effective.

Repellents for Meadow Mice

The meadow mouse (Microtus spp.) is the rodent most responsible for damage to young forest trees in the United States. Again, any one of the four commercial repellents will protect large seedlings from damage by meadow mice, but all are less effective in safeguarding small seedlings. Since a relatively small basal area requires treatment, a high concentration of the repellent can be economically used to protect forest seedlings. As with rabbit repellents, it is more economical to apply the chemical to seedlings in the nursery before lifting or after they are bundled. Laboratory tests proved TNB-A to be more effective on meadow mice than the other three repellents.

Repellents for Other Rodents

Young trees may also be damaged by other rodents such as cotton rats (Sigmodon) and pine mice (Pitymys), but little is known of the effectiveness of repellents against these and other species of small rodents.

Dilution Rates for Repellents

Dilution rates of repellent concentrates for preventing damage to woody plants by rabbits, hares, and meadow mice are suggested in table 1. These percentages of active ingredients agree with the manufacturer's recommendation.

TABLE 1--Suggested dilution rates for three repellents for rabbits, hares, and meadow mice

Damaging animal	Product ¹	Amount of active ingredient to apply		
		Winter	Winter ²	Summer
Rabbits and hares.....	TNB-A ³	<i>Percent</i> 5	<i>Percent</i> 5	<i>Percent</i> (⁴) 1-2
	TMTD	7-10	3-5	2
	ZAC	10	5	---
Meadow mice.....	TNB-A	5	5	---
	TMTD	7-10	---	---
	ZAC	10	---	---

¹ Generally listed in descending order of effectiveness for each animal.

² Suggested rate if only light or moderate damage is anticipated.

³ Not to be used on growing plants or conifers. Not adaptable to dilution.

⁴ Not for use in summer.

Methods of Applying Repellents

Young trees can be treated with repellents most economically while still in the nursery. Application can be made either by spraying the seedlings in the nursery beds with a small hand sprayer or with a tractor-mounted power sprayer, or by dipping the bundled seedlings in a repellent suspension. After either treatment, the repellent films should be allowed to dry for a day before the seedlings are planted. Repellents containing an organic solvent base require considerably less drying time than water suspensions.

Refinements in methods of application are still needed, but some procedures are known that overcome difficulties encountered with present formulations. If the spraying method is employed, the water-based repellents should be strained through a 50-mesh screen into the spray tank to prevent small rubber particles contained in the adhesive from clogging the sprayer. Screens in the spray nozzles should be 50-mesh, and orifices 1/2 mm. or larger should be used. Tank pressures of 30 to 50 p.s.i. yield the most uniform treatments.

One hundred to three thousand trees can be treated with a gallon of repellent depending on the kind and size of the trees and how much of the tree is to be covered. The number of trees per unit of nursery bed is an important factor when spraying; if the trees are densely planted, heavier application rates of more dilute dispersions will be needed to coat the basal parts of the seedlings. Likewise in dipping, species and size of tree, tightness of the bundle, and type and viscosity of the repellent suspension (determined by the season of use and species of animal as shown in table 1) will determine uniformity of the coatings and hence the numbers of trees that can be treated per gallon of repellent. In each instance, whether the trees are sprayed or dipped, the nurseryman must determine the application rates that will give uniform coverage.

Repellents applied by backpack sprayers can also be used to protect established plantations from rodent and rabbit damage, but because of labor, the cost per tree is high. As with nursery treatments, on-the-spot adjustments must be made in application rates for proper coverage.

Summary

Four commercial repellents, the active ingredients of which are trinitrobenzene-aniline, tetramethyl thiuram disulfide, and zinc dimethyldithiocarbamate cyclohexylamine complex, are available for protecting young forest trees from rabbit and rodent damage. The repellent films may remain effective for a year or longer in some instances.

Seedlings can be treated economically by spraying while still in the nursery beds or by dipping while in bundles. Through such treatments, Douglas-fir seedlings have been protected from rabbit damage for less than one dollar per thousand. Trees in plantations may be protected by individual spraying, but the cost will be higher, primarily for labor.