



## Managing Voles in New Hampshire Orchards and Highbush Blueberries

Dr. Alan T. Eaton, Extension Specialist, Entomology

Two species of small rodents regularly damage orchard trees and blueberries in New Hampshire. Orchardists frequently call them mice, but they are voles. The pine vole, *Microtus pinetorum*, primarily attacks roots and lives underground, while the meadow vole, *Microtus pennsylvanicus*, is active above ground. Both species eat bark in winter and can girdle trees and bushes above ground level. Populations of these pests can fluctuate greatly from year to year. This can result in severe injury in peak years. In winter, fruit and live grass are unavailable as food, so they turn to eating bark. With good snow cover, the voles are hidden from view of predators, so damage can be especially bad.

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Pine vole (top, with short tail) and meadow vole (bottom, with long tail). Photo: Alan T. Eaton



Girdled tree. Photo: Alan T. Eaton

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## ***Did You Know?***

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### **Pine Vole**

The pine vole is a fossorial species. That means it lives underground and spends very little time above ground. In the winter it spends a lot of time above ground, but under the snow. My orchard trapping surveys (1980's) and records from Rene Bollengier, U.S. Fish and Wildlife Service, indicate that in New Hampshire, pine voles occur **in apple orchard habitat** in at least six counties. They were south of a line roughly extending from Dover to Concord, and then northwest to Franklin and Plainfield. They might occur in orchards north of this line, but I could not find them. In blueberry plantings, the pattern was similar. The farthest north I found pine vole in blueberries was in Barnstead. Textbooks show that in appropriate habitat, the species occurs in the southern 2/3 of the state; not Coos County or the northern parts of Grafton and Carroll Counties. They prefer woodland and grassland habitats, but are also found in rocky areas, marshes and swamps. They feed almost exclusively in their tunnels and eat fruit, tubers, roots and the bark along roots of certain trees such as apple. In orchards, the extensive burrow systems reach from the tree bases to the drip line, and many tunnels are only one to three inches deep in the soil. The tunnels are usually shallow near the drip line and are deeper towards the trunk. They're usually one to 1 ½ inches wide. Tunnels often parallel large roots, and gnawing by the rodents sometimes causes rows of suckers to sprout. Soils that are the most favorable for this species are sandy, with sufficient silt, clay, or other cementing agent content to keep tunnels from collapsing. Thick layers of surface litter seem to be favorable as well. Tunnels almost never cross the compacted driveways.



**Meadow vole. Photo: Alan T. Eaton**

The species is gregarious. The breeding season goes from mid-February to mid-November, and usually there is one litter of two to four young per year.

### **Meadow Vole**

The meadow vole occurs throughout New Hampshire in orchards, open woodland, grassy marshes and meadows, wooded swamps and along streams and lakes. Unlike the pine vole, it is active primarily above the ground and builds networks of runways in the grass and surface debris. Sometimes it burrows into the ground, but such tunnels are usually close to the trunk. Thick growth of grass or other plants is favorable for this animal. It feeds on grasses, sedges, legumes, seeds, grain, tubers, and dropped fruit. When more favorable foods are scarce, it eats the bark and cambium layer of trees. Much of the typical girdling by this animal is done under the cover of snow, and injury can occur on any part of the trunk or branches which are covered by snow. Young trees are especially vulnerable to girdling. Besides apple, meadow voles attack peach, plum, quince, pear, cherry, blackberry, raspberry, rose, grape, blueberry, juniper, dogwood and other ornamental and



**Vole teeth. Photo: Alan T. Eaton**

forest species. This species is gregarious and very prolific. The breeding season lasts all year, and females usually have four to eight litters per year, with an average of four or five young per litter. With such a high reproductive rate, meadow vole populations can rebound quickly from heavy mortality (for example, from rodenticide application).

### Identification

Adult **meadow voles** are about seven inches (150 to 195 mm) long with a tail that extends another 33 to 65 mm (1¼ to 2½ inches). The tail is at least twice the length of the **hind foot**, although immature voles have slightly shorter tails. They are chestnut brown with gray underparts. Their ears are furred and project slightly above the fur on the head. The eyes are prominent. The fur is coarse.

Adult **pine voles** are smaller, with a body length of 110 to 135 mm (4¼ to 5¼ inches). The tail is 15 to 26 mm (6/8 to 1 inch) long and is about equal in length to the **hind foot**. The eyes are somewhat sunken, and the ears are nearly buried in the fur. The fur is less coarse than that of meadow vole, and is a lighter brown color.

Other small mammals are common in orchards and blueberry plantings, and may be confused with one of these voles. Moles are burrowing mammals with pointed snouts, many small, pointed teeth, and **large powerful front feet which are adapted for digging**.

The species you would be likely to encounter in an orchard habitat (**hairytail mole**) eats earthworms, slugs, grubs and insects, but not plant foods. The **northern short tailed shrew** is an abundant small gray mammal which preys on insects, worms, small salamanders and small rodents. It has a pointed snout, 5 toes on the front feet, fine gray fur, no visible ears, and incisors (front teeth) which are pointed, white at the base and dark brown at the tips. Both moles and shrews are insectivores, not rodents. Their teeth are quite different from rodents, reflecting the different diets they have. Both insectivores have weak eyes that are often hidden by fur.

Deer mice and white-footed mice are rodents that we sometimes see in orchards or in storage buildings. They have prominent eyes and very long, bi-colored tails which are white below and gray or brown beyond the fur on their heads. They are usually brown with white underparts. They have the usual tooth arrangement of all rodents (including voles): the front incisors are chisel shaped. Behind the incisors is a long gap with no teeth, then several grinding teeth at the rear of the jaw.



Hairytail mole. Photo: Alan T. Eaton



Hairytail mole teeth. Photo: Alan T. Eaton



Northern short tailed shrew.  
Photo: Alan T. Eaton



Northern short tailed shrew teeth.  
Photo: Alan T. Eaton



**White-footed mouse.**  
**Photo: Alan T. Eaton.**

### **Damage to Orchard Trees**

Most pine vole damage is not readily visible unless you uproot the trees. Signs of pine vole injury to orchard trees include a reduction in tree vigor, dwarf leaves lacking dark green color, the presence of many suckers or a severe drop in yield. In serious cases, the tree sits loosely in the ground, and is easy to uproot. Signs of activity include spongy soil with visible burrows and “tailings”. Most injury occurs when the vole chews off small roots and chews the bark on large roots. Under the cover of snow, pine voles girdle lower trunks, just like meadow voles.

Meadow vole injury is much more obvious: large areas of missing bark, with small parallel tooth marks. It becomes evident as the snow melts in early spring. Extensive feeding on the bark of low branches, prunings and trunk is most probably from meadow voles. Occasionally cottontail rabbits similarly damage trees, but in New Hampshire, this is increasingly rare, due to decline in cottontail populations. Voles often girdle young trees, forcing growers to replant new ones. Growers can sometimes save old trees with large areas of injury, by bridge grafting. Often the wound never completely heals, and insects and pathogens gain entry. Apple trees of **all ages** are susceptible to injury. In addition to apple, voles attack other orchard trees: peaches, nectarines, and occasionally, cherries.

If you use soap bars to deter deer feeding on your trees, take care not to place bars where soap drips onto the trunk or base of the tree. Both species of voles readily feed on sites where soap drips onto the bark.

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### **Damage to Highbush Blueberries**

Most highbush blueberry plantings are mulched with various organic materials, and often the plant rows are several inches above the drive rows. Meadow vole girdling is uncommon in our highbush blueberries, except in situations with severe weeds in the rows. Underground in-row tunneling is quite common,



**This young tree was completely sheared off by voles.**  
**Photo: Alan T. Eaton.**

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especially in situations with pine needle or sawdust mulch. Root zone tunneling seems to be less common in situations where coarse bark or shredded wood mulch is heavily applied. That might be misleading... the coarse mulch may just make it harder for us to detect tunneling. Research shows that pine voles can exist on a diet of 100% blueberry roots. A diet of apple roots must be supplemented by roots of various forbs, for pine voles to survive. Blueberries that sustain heavy root feeding show poor growth and production. Examination of their root systems shows that many of the fine roots are missing.

### **Measuring the Vole Population**

Visual checking or probing can give you a rough idea of the vole population. Sites heavily populated by pine vole are easy find by probing the soil with your fingers, looking for tunnels. Small tunnel openings surrounded by small soil piles are another clue. As you walk on the soil under the tree canopy, the soil can feel spongy (from the burrows underneath). You can see meadow vole runs most easily in taller grass, by kneeling down and parting the grass. Active runs look like tiny one to two inch wide paths through the grass. Active runs often have grass clippings (remains of meals) in them during the growing season, and you might spot a dropping or two at any time of year. Droppings are roughly one mm wide, three to four mm long (1/16 inch wide, 1/8 to 3/16 inches long. If the orchard usually has tall orchard floor vegetation, expect that meadow voles are there. In a site that is well-mowed, meadow voles are most likely along the borders with adjacent grasslands, or brushy woodlands and stone walls.

There is one indicator of population size that we use to judge population reduction, after applying rodenticide. We place 30 to 50 apples across the orchard floor, under the tree canopies. I usually mark mine with wire flags, so I can easily find & count them. After two or three days in the orchard, I remove them, and count how many got chewed. Ten days to two weeks after applying a rodenticide, repeat the procedure and compare the numbers that got chewed before and after treatment. This gives you a rough idea of activity, and is simple to do. It works much better if you remove drops from the orchard first. In a blueberry planting where pine voles are suspected, this method can work if the apples are placed over tunnels: probe to find a tunnel, remove some overlying debris, and place an apple there.

Some growers try surveying by trapping. It can work, but tiny details in procedure have a major effect on trapping results. Standard mouse traps with strong springs are the most effective. I have found "Victor" mouse traps to have springs that stand up well to orchard work, much better than other brands.



**Trap with modified bait holder. Photo: Alan T. Eaton.**

For meadow vole, search for active runs in the orchard floor vegetation. Place the bait end of a trap extending into the run. Bait the trap with a tiny wedge of fresh apple. I modify the standard metal bait holder by cutting it into a wedge. That is perfect to impale a small, fresh cube of apple. Mark the trap site with a wire flag or bright plastic flagging, or you'll lose track of where it is. Tying them to an anchor stake will prevent small scavengers from removing the trapped animal and the trap, before you can find and identify the catch.



**Baited vole traps ready to set. Photo: Alan T. Eaton.**

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For pine vole trapping, you have to move below ground. Search for active pine vole tunnels by probing with your finger until you poke through a tunnel. (They are about an inch across.) Carefully excavate a spot large enough for the trap, positioned so that the trap is at level with the bottom of the tunnel, and the bait reaches almost to the middle of the tunnel. Be sure you have not blocked the tunnel with soil. Reach carefully up the tunnel (in both directions) with a finger and clean out any debris you created in the tunnel by your activity. As with meadow vole, use a small piece of fresh apple as bait. Cover the trap with a board, broken apple box, shingle or other material so that it blocks out all light. **Be certain the cover is high enough above the trap to not interfere with the spring bar when it is triggered.** Even if the spring bar just brushes the roof when triggered, the delay usually means the vole escapes. Mark the trap location with a wire flag or bright flagging. Pine vole is easiest to trap in May and June, or mid-September through mid-November.

Check traps daily, and replace the bait daily. Keep track of your catch by writing it down. If you have a pick-your-own orchard, trapping is NOT a good idea when customers are present.

### Management Strategies

Many orchardists rely heavily on rodenticide use, without knowledge of which species of rodents are present in the orchard or which methods are most appropriate for orchard conditions. The result is often incomplete control and damage in years of high populations and favorable conditions. The most effective management plan is one that takes into account which pests are present, their relative abundance and relies on a program of direct controls and techniques to suppress populations to below levels of economic injury. Suppressive measures alone such as sanitation, mowing and maintenance of weed-free strips can go a long way toward preventing vole problems. Here are several different management techniques which can be selected and combined into a management program which fits your particular orchard situation.

### Tree Guards

Good tree guards are the most effective measure for preventing tree girdling by meadow voles, but they are labor-intensive to set out, and some materials are very rough on workers' hands. If they are properly set and maintained, they prevent damage for many years. Many different materials are available for this purpose. Height affects cost and protection. Low guards are inexpensive, but they allow vole entry in winter if snow depth goes above them. Taller guards prevent damage in deep snow, but are more expensive.

Galvanized hardware cloth is one of the best materials for tree guards. I recommend one-quarter-inch mesh (or 3/8 mesh if you can find it) in 24-inch width. One half inch mesh is large enough that occasionally

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**Hardware cloth vole guard.**  
Photo: Alan T. Eaton.

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a young vole could get through and damage a tree. Cut the cloth large enough to completely encircle the tree and allow enough room for 10 or more years of growth. Form it into a cylinder and use the cut ends to fasten it together snugly so that no gaps are left for the voles to gain entry. Two or three short pieces of wire may be necessary to secure the ends. Embed the guards at least two inches into the soil to prevent the rodents from burrowing underneath. Check the guards annually, preferably before the ground freezes. They can last many years. In fall of 2012, the price for quarter inch mesh hardware cloth in 36" width was about \$60 for 50 feet; \$86 for 48" width, and half inch (36" high) was about \$58. The major drawback to hardware cloth is that it is difficult to work with, and rough on workers' hands. Cutting each guard off the large roll, and installing it can be time-consuming.

Several rigid, perforated polyethylene or plastic mesh products are being promoted for use as tree guards. Use them in a similar way to galvanized hardware cloth (explained above). They are easier to cut from the roll, and easier to handle than wire guards, but some may break down by exposure to ultraviolet light and may have a limited life. Some are pre-cut to standard heights and widths. Costs of the plastic materials vary. A typical fall 2012 price was \$130 for a 100 foot roll. Frequently, companies sell plugs designed to fasten the edges together. Skimping on fastening can leave gaps big enough for voles to get through.



**Plastic mesh vole guard. Photo: Alan T. Eaton.**



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Punched metal tree guards are available as well. They are byproducts from producing metal washers. They usually have a rubber backing, and the holes are typically 19/32 inch across. These are already cut to length (a bit too short for some applications), and can be purchased flat or pre-rolled, for \$2.70 to \$3 each. That hole size is a little bit big, and may admit some pine voles or immature meadow voles. I frequently see that growers did not fasten the ends together, and tree growth opens up the guard, admitting voles. Some growers like that this material protects the lower trunk from string trimmer injury.

Wrap-around solid (not net-like) plastic guards are cheap and very easy to install. I do NOT recommend their use unless you remove them every spring and put them on again every fall. Apple bark borers, dogwood borers, leopard moths, and possibly round-headed apple tree borers seem to prefer trees with wrap-around plastic or paper guards. The guards provide excellent refuge for San Jose scale to survive insecticide sprays. They also leave the underlying bark tender and it hardens off slowly. The plastic may become brittle when weathered, and these guards are difficult to keep in place on trees with uneven trunks or swollen graft unions. Prices averaged \$.90 to \$1.20 each in fall 2012.

I do not recommend paper wrap-around guards. They must be tied in place with string or wire, which can girdle the tree unless it is removed each spring. I have found very high populations of bark borers and San Jose scale in trees “protected” with this material. The treated paper also weathers quickly, and the underlying bark remains tender and hardens off slowly.

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**Spiral tree guard, not recommended. Photo: Alan T. Eaton.**

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### **Mowing and Sanitation**

Maintaining a closely-mowed orchard floor greatly reduces the chances of meadow vole buildup. I feel it is the most effective single technique to protect trees from meadow vole. It has little or no effect on pine vole. Keeping the orchard floor short exposes the rodents to their numerous predators, including hawks, owls, crows and ravens, weasels, skunks, cats, dogs, foxes and coyotes. One or two mowings a year are not enough, since meadow vole reproduces so prolifically. Prunings which are left in the orchard, piles of debris and weedy orchard borders also offer good cover for meadow voles. Mowing equipment that finely chops the vegetation is better at reducing cover than sickle bars which leave a protective canopy of cut vegetation under which the rodents hide.

The maintenance of weed-free, under-tree strips also reduces cover for meadow voles. Herbicides are usually used for this purpose, but I won't cover herbicide options here. Weed-free under-tree strips can affect pine voles somewhat since they would normally feed on the roots of many of the under-tree weeds which are controlled. Such effect is greater when you apply the weed control program over a long period of time.

Fallen apples (or those hanging low enough to touch the ground) are very attractive to both pine and meadow voles. Elimination of drops is of key importance where the use of rodenticides is planned, since the rodents often prefer apples over the poisoned bait.

### **Encouraging Vole Predators**

Providing nesting cover, nest boxes, and/or hunting perches for hawks or owls theoretically could help reduce vole numbers. This has been demonstrated for some small mammals in Florida and the Pacific Northwest. It is less likely to help here. One of the few effective winged predators that readily uses nest boxes (barn owl) is very rare in New Hampshire. Sparrow hawk (also called American kestrel) readily uses nest boxes of the proper dimensions, if appropriately placed. My publication on this subject is still on the UNHCE website at [https://extension.unh.edu/resources/files/Resource001797\\_Rep2514.pdf](https://extension.unh.edu/resources/files/Resource001797_Rep2514.pdf).

Protecting foxes may help as well. They heavily prey on voles. Less common (or less visible) are mink and otter (both likely near water) and weasels. Skunks, cats and dogs also prey on voles. Short tailed shrew is sometimes abundant in orchards, and it can kill younger voles. Our other shrews are probably too small to be significant vole predators. Limit your use of rodenticides, and, if you do use them, be extremely careful to 1) minimize the chances that predators can reach the bait, and 2) avoid those products most likely to cause secondary poisoning (read below).

### **Trapping as a Control Measure**

I describe trapping on page 5, under “measuring the Vole Population”. For someone who pays careful attention to detail, has a very small planting, and lots of time, trapping might significantly reduce pine vole numbers, but is unlikely to control meadow vole (too prolific).

### **Rodenticides**

Think of rodenticides as an optional component of a vole management program rather than serving as the total control effort. Growers can choose between several different application techniques, depending on the size of the orchard, the severity of the problem, and the availability of labor and equipment. Labels for all (current) rodenticides registered in NH orchards and blueberries state that application occurs after harvest is complete, and before growth begins in the spring.

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Be especially cautious in using rodenticides. If pets or wildlife can reach the bait, they can be poisoned. Numerous wildlife studies in the USA and elsewhere in the last 15 years point to major wildlife hazard posed by our use of rodenticides. The reports are sobering and scary, especially with respect to second-generation anticoagulants (brodifacoum, difethialone, bromadiolone). One toxicant (brodifacoum) has been found in an amazingly high percentage of various dead, sick or injured predatory birds and predatory mammals in the northeast. EPA responded by drastically reducing the availability of brodifacoum products for use by non-licensed applicators. But it is still available for licensed applicators, in and around buildings.

Two types of wildlife poisoning can occur: 1) direct consumption of the rodenticide bait and 2) indirect, or secondary consumption: a predator eats an animal that was poisoned by the bait. The second generation anticoagulant rodenticides have a high risk of secondary poisoning because 1) the toxicant may take 3 – 7 days to kill the target rodent; 2) a vole/mouse/rat might have the equivalent of many lethal doses in its body; 3) the chemicals are especially toxic to many raptors... hawks, owls, falcons, eagles; 4) lethargic victims are especially vulnerable to capture by predators. My colleague Marion Murray (Utah State Univ) wrote: *“Both California and NY veterinarians have surveyed for anticoagulant ingredients in the blood and organs of dead raptors and other wildlife. Of the species tested, anticoagulants were found in 79% of fishers, 78% of mountain lions, 70 to 81% of owls, and 49 to 92% of raptors.”*

First generation anticoagulants (diphacinone, chlorphacinone, warfarin) have significantly lower risk of secondary poisoning. Zinc phosphide is an example of a product with a very high risk of primary poisoning: if something eats the bait, it will probably die, within hours. The toxicants are potentially dangerous to people as well, either by ingestion or inhalation of dust during mixing and loading. It is essential to carefully read the label before use. Also, this can be very helpful before you purchase them.

The labels of most products are accessible via internet. Search websites of the manufacturer, or search the NH registry database (accessible via NH Department of Agriculture, Markets & Food website). The Crop Data Management system website ([www.CDMS.net](http://www.CDMS.net)) has very few if any rodenticide labels in its database.

Current rodenticide registrants include:

- HACCO - [www.hacco.com](http://www.hacco.com)
- Bell labs - [www.belllabs.com](http://www.belllabs.com)
- Liphatech - [www.liphatech.com](http://www.liphatech.com)

If you find a product online that you'd like to use, the Pesticide Regulatory Division of NHDAMF can tell you if it is legal for use (registered) here in New Hampshire. In my July 2017 search (done during re-formatting), I found 5 products registered for use in NH orchards and/or highbush blueberry plantings:

- Rozol Vole Bait (Liphatech, Inc) EPA reg. #7173-242 [chlorphacinone, for orchards, nurseries and some other sites, but not in blueberries.]
- ZProdent Oat bait AG (Bell Labs, Inc) EPA reg. #12455-102 [zinc phosphide, for orchards, highbush & lowbush blueberries.]
- ZP rodent bait AG (Bell Labs, Inc) EPA reg. #12455-17 [zinc phosphide, for orchards, grapes, highbush & lowbush blueberries and other sites.]
- Ramik brown (HACCO) EPA reg #61282-45 [diphacinone, for use in orchards, Christmas trees, some other sites. Not for use in blueberries.]
- Prozap ZnP pellets (HACCO) EPA reg #6182-49 [zinc phosphide, for use in orchards, high & lowbush blueberries, brambles and other sites.]

These are subject to change every year, especially details about bait stations.

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**Hand baiting** is the most labor-intensive method, but can be the most effective method for pine vole control. With some rodenticides, this method requires less bait per acre than broadcast treatments. Hand baiting is most efficient when **bait stations** are used. These are old boards, shingles or other materials which you placed under each tree and leave there for months or years. Some growers successfully use half-tires. You cut the tire as you would a bagel. Tires with metal incorporated in the tread are very difficult to cut. Usually, after a few months in place, the voles have made a network of trails and tunnels under the bait station. When application time arrives, it is easy to lift the bait station and place a spoonful of the rodenticide right where the rodents are active. Lowering it back down protects the bait from rain and keeps birds and most other non-target animals away from the poison. With some rodenticides, minimum bait station sizes are given on the label. Be sure you check the label and comply with the regulations.

In this publication I do not intend to cover use of rodenticides **in or around buildings**. That is generally called “commensal” rodent control, and it frequently requires the use of tamper-proof bait stations, which are commercially available.

If your rodenticide label allows it, bait stations can be made from 1 ½ inch diameter PVC pipe in the shape of a T, with a vertical section 16 to 20 inches high. These can be supported by a stake or tree trunk, with a tin can covering the top. This design allows you to place rodenticide after the snow falls, with minimal disturbance. This design can be even more effective if a small board or shingle is rested over one or both ends, thus creating a small roofed hiding spot. Unfortunately, this sometimes interferes with mowing operations. The T-stations are most likely to help for meadow vole, not pine vole.



T-shaped pvc bait station. Photo: Alan T. Eaton.

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Sometimes we use hand placement of bait in runs and burrows, without bait stations. The effectiveness of this method varies greatly with the skill or motivation of the applicator. Basically, the applicator wears rubber gloves and spoons the bait into burrow openings or surface runs. It is important to pull back the grass to cover the bait after placement in runs. Disturb the runs as little as possible.

**Broadcast applications** are popular because you can very quickly cover large acreage. They can be very effective for meadow vole control, but are much less effective for pine voles. The idea is to spread the bait through the orchard floor cover, where voles will search for it. The vegetation also helps hide the bait from view of non-target organisms, like birds. Broadcasting is most effective when fair weather lasts for several days after application, and the bait falls into cover frequented by the voles. Baiting bare spots or leaving the bait in piles is *much less* effective and can result in poisoning non-target animals. Birds are most frequently victimized when cracked corn bait is used. Turkeys are especially vulnerable, but blackbirds, grackles, starlings and jays have been victims as well.

The **trailbuilder** is a piece of tractor-drawn orchard equipment that is still used by some orchardists. Some labels still give instructions and rates for its use. The device creates shallow tunnels in soil under the tree canopy and distributes bait pellets through them. It can be tricky to use, but can be effective for pine voles.

Rodent control in and around buildings: that is beyond the scope of this publication, but many orchardists now follow GAP procedures which require (among other things) use of rodenticides in bait stations in/near their buildings. *I strongly urge you to avoid brodifacoum product use in this situation. The risk of predators (including your cat or dog) eating a rodent being poisoned is high.*

## **Types of Rodenticides**

Anticoagulant rodenticides like chlorophacinone and diphacinine usually require repeated feedings to cause death. Rozol® and Ramik® are common anticoagulant rodenticides. Poisons in this group kill mammals in two ways: they reduce the clotting abilities of the blood, and they damage the fine blood capillaries in the body. Death appears to be painless. Diphacinone (the active ingredient in Ramik) is very toxic to dogs and almost as toxic to cats.

Zinc phosphide is an inorganic compound which is a black powder. It is available formulated on oat or cracked corn baits. It is a quick-acting poison, which can kill with only one feeding. It is very toxic, and zinc phosphide baits should always be handled with care. Handling the baits with bare hands or inhaling the dust when pouring or mixing baits are both likely ways to be poisoned. Zinc phosphide kills by releasing phosphine gas when it contacts acids. It is poisonous to many birds and mammals and has a garlic-like odor which makes it unattractive to some animals. Many rodents are attracted by the odor. Moisture causes the toxicant to break down, another reason to avoid baiting in damp weather. Animals poisoned by zinc phosphide usually die within 30 hours of eating the bait.

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## Sources of Help

USDA Wildlife Services staff are available to assist with a variety of wildlife damage issues, including voles. Their telephone number (Concord, NH) is 223-6832. <https://www.aphis.usda.gov/aphis/home/>

Pesticide registration, pesticide use permits & licensing are handled in New Hampshire by the Pesticide Regulatory Division of the NH Department of Agriculture, Markets and Food. [www.agriculture.nh.gov](http://www.agriculture.nh.gov) or telephone number is 271-3550.

UNH Cooperative Extension has staff that can assist with voles and other issues. Our website lists the various offices (and telephone numbers) throughout the state. [www.extension.unh.edu](http://www.extension.unh.edu)

**Stop!** Read the label on every pesticide container each time before using the material. Pesticides must be applied only as directed on the label to be in compliance with the law.

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