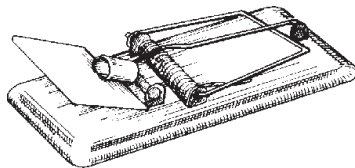


## ORCHARD VOLES

Two vole species cause serious orchard damage in New England by gnawing on trunks and large roots. Vole damage causes lower yields and higher tree mortality. The meadow vole ranges throughout New England. The pine vole is known to be present in orchards in the southern New England states, and in the southern parts of Vermont, New Hampshire, and Maine.



Meadow voles inhabit the orchard floor, developing a network of surface trails through the groundcover, and they feed primarily on grasses and fleshy herbs. Most of an individual meadow vole's activity is within an area of about 2000 square feet. Because of their prolific breeding, a few overwintering voles in the spring can lead to a damaging population in the fall. Vole damage is possible any time of the year, but primarily occurs from late fall to early spring when other food sources are scarce. Vole feeding leaves 1 millimeter-wide tooth marks at various angles, compared to the wider and less varied marks left by rabbit feeding. Meadow voles chew away areas of bark and cambium near the ground line or from higher positions on the trunk reachable from the top of snow cover. In some soils they will burrow, and are capable of causing damage several inches below the ground surface.

Pine voles travel in burrows within the drip line at depths up to 3 feet or more, depending on soil conditions. In solid grass sods they may be almost totally subterranean, but where the groundcover contains a high percentage of broadleaf herbs, pine vole surface trails may be numerous. Most of an individual pine vole's activity is within a small area of about 400 square feet. During the cold months, their activity is largely limited to the underground burrows. On apple trees, pine voles feed upon bark and cambium primarily below the soil line, and chew off small roots up to about pencil diameter.

Symptoms of vole damage include poor shoot growth, small leaves, leaves that turn off-color early in the fall, and small, highly colored fruit. Young trees are more susceptible. Vole population density varies even across small areas. To locate areas with vole activity, look for injured trees, girdled trunks, chewed prunings, runways in the grass and around

trees, or dropped fruit bearing gnaw marks.

Pine vole tunneling and feeding may be indicated by spongy soil, burrow entrances with piles of soil "tailings", and numerous shoots arising from surface roots.

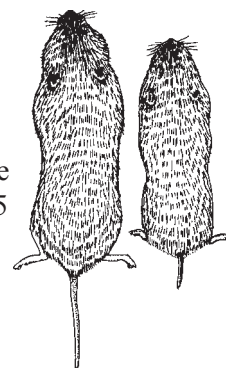
Commercial apple cultivars and rootstocks are very susceptible to vole feeding. Young trees (1–15 years old), and dwarfing rootstock are the most likely to be damaged. Because of the numerous risk factors and high cost of establishment of high-density apple orchards on dwarf rootstocks, considerable effort should be made to eliminate voles from the orchard. In a nutshell, good ground cover management equals effective vole management.

### IDENTIFICATION OF VOLE PESTS

It is important to determine if pine voles are present, because some of the management practices used for meadow vole are not effective against pine vole. Trapping is too time consuming for use as a control measure in large plantings, but it is the best way to identify which species are present.

Traps placed on the surface most likely will not capture pine voles. Find subsurface burrows by probing with your fingers 2 to 3 inches deep at the drip line, deeper near the trunk. Then, carefully excavate an area of sod or soil just large enough to allow a standard wood mouse trap to sit flush with the bottom of the underground runway. Place the trap lengthwise across the trail with the trip pan in the center. Use small chunks of apple, rolled oats, peanut butter, or a combination as bait. Cover each trap site with a shingle to prevent other animals from tripping it and to help relocate it 24 hours later. Trap for 3 or 4 nights, then repeat a week or two later. Record the number of each species caught at each trap.

Tail length is useful for identification. The pine vole tail is very short; about the same length as the hind foot (not leg!), measuring 3/4 inch or less. The meadow vole tail is about twice the length of its hind foot, reaching 1.5 to 1.8 inches on adults. Pine voles have chunky bodies, small beady eyes and small ears almost concealed in smooth brown fur.



Meadow voles have more prominent eyes, larger bodies, and longer tails than pine voles. Their fur is coarser, more gray than brown.

A long-tailed specimen is likely to be a white-footed mouse (*Peromyscus*). The tail of this species well over 2 inches long, and all of its underparts are covered with white fur. It has very large ears and large eyes. It is reported to eat bark of young trees occasionally, but is generally considered a non-pest species in orchards.

Your traps may also catch a shrew, which is a beneficial small mammal; or a mole. Shrews can be identified by their long pointed snout and needle-sharp front teeth, which are white at the base and dark brown at the tips. (Voles have chisel-shaped front teeth). Moles can be distinguished from the other groups by their large front feet with outward facing palms and prominent digging claws.

### ESTIMATING VOLE ACTIVITY

Bait stations can be used to identify areas with vole activity, to assess the vole threat in the orchard overall, or to check 2 to 3 weeks after a treatment to see if a follow-up treatment is needed.

Bait stations can be made from shingles, split tires, or boards, placed in grass at the edge of the herbicide strip or drip line. Establish the stations in the spring or summer to give the rodents time to find and tunnel under the board. Tree flagging helps to find the stations later. A full block survey requires a station at least every fourth tree in a center row, and also along a diagonal row across the block.

After harvest, check under each station for tunneling. In each station with a run or tunnel, place a 1-inch thick apple slice in the runway or next to the hole, then recover it. Check the stations after 24 hours. If the percentage of apple slices that have tooth marks (or are entirely missing) exceeds 20%, this indicates potential for serious vole damage. A record of repeated assessments over a period of months or years gives a more accurate indication of vole activity. These vole monitoring stations can be used later as bait stations for control.

A general estimate of vole activity can be made by looking for meadow vole surface runways and pine vole tunnels. Voles usually nest near the base of a tree trunk. The combination of a trail/tunnel survey and apple slice feeding tests gives a better assessment than either method used alone.

### PREVENTION AND CONTROL

Poison baits provide short term population reduction, and are a necessary tool in emergency situations. However, rodenticide is a supplement, not a foundation for vole management. A successful vole damage prevention program requires a comprehensive approach that includes individual tree protection and groundcover management.

In a NY research trial, adequate vole control was achieved without use of rodenticides through a combination of regular close mowing of alleys, herbicide application in tree rows, tree guards, late autumn trapping, and contiguous habitat for vole predators.

Properly installed tree guard made of heavy gauge wire or plastic, are very effective in preventing most meadow vole damage unless snow depth exceeds guard height. Voles tunnel through snow to any depth. Embed guards at least 2 inches below the surface. Trunk guards do not prevent underground damage by pine voles. Close-fitting plastic spiral trunk wraps are less effective and can provide favorable habitat for trunk-boring insect larvae.

Keeping orchard floor vegetation below 10 inches (below 4 inches is best) with regular mowing discourages vole activity aboveground because it leaves them visible to predators. Flail and rotary mowers do a much better job than sickle bar mowers at making orchard ground cover less suitable for voles.

An herbicide strip to kill vegetation in the tree row; removing brush and weedy areas around the orchard; and removing or mowing dropped apples, are effective ways to reduce or even eliminate meadow voles from the orchard. There is little vole activity on ground with less than 40% vegetative cover. While hay-straw or fabric mulch can exacerbate vole problems, a NY trial found that wood chip and bark mulch did not. Removing sucker growth, which attracts voles, also helps suppress meadow voles. To a lesser degree these practices can reduce pine voles which live primarily underground.

There are two types of rodenticide baits for vole control: zinc phosphide and anticoagulant (see *Notes on Rodenticides*). Just 1 or 2 fresh grains or pellets of zinc phosphide baits can quickly kill a vole that eats them, but it may take several days of feeding on anticoagulant baits to kill a vole. Zinc phosphide baits have been more effective than anticoagulant baits against meadow voles.

Zinc phosphide is most effective when delivered as treated steam-rolled oats or as pellets. Zinc phosphide-coated cracked corn is less effective. Unwaxed bait is preferred to reduce hazard to wildlife. Zinc phosphide loses its toxicity rather quickly if the bait becomes wet. To preserve toxicity of unused zinc phosphide baits, place the opened package within a plastic bag and seal tightly.

**Nontarget Hazard: Rodenticide baits may be attractive to domestic pets, birds and other nontarget wildlife. Exposed bait, particularly waxed corn or grain-based pelletized bait on bare ground, increases the chances of nontarget injury. As with all pesticides, use good judgement and take reasonable precautions to avoid problems.**

## RODENTICIDE APPLICATION

**Broadcast** bait application is fast, particularly if applied with a fertilizer spreader, and can be effective against meadow voles. It is usually not effective against pine vole. Placing the baits within a weed-free herbicide strip will probably not be effective because voles avoid open ground. Most product labels limit treatments to the postharvest dormant period. The presence of dropped apples can make baiting ineffective, as firm apples are a preferred food for voles. Therefore, all sound drops should be removed before bait is broadcast. If the weather is wet and dark during the first few days after bait is broadcast, the baiting effort will have been wasted. Wet weather and dark days discourage vole activity, and wet bait loses potency and palatability. The best timing for bait application is soon after a postharvest mowing, and before a 3-day period of sunny, dry weather. The goal is to reduce the vole population just before winter.

Brushy overgrown areas adjacent to a vole-infested orchard are likely to have a population of the same species present in the orchard. If these border areas are not baited, they will be a source of reinfestation to the treated orchard.

**Baiting in Artificial Trails:** Used properly, tractor-drawn mechanical trail builders allow for more efficient bait application that is effective against pine voles as well as meadow voles. A trail is made along each side of the tree rows, beyond the wheel tracks, beneath the drip-line in sod.

Proper depth setting of 2 to 4 inches, timing

and suitable soil conditions are critical for success. If there is vehicle and foot traffic in the orchard after the trails are built, or if the soil is too dry, the tunnels will collapse and bury the poison. If the soil is too wet the poison degrades quickly. This method is more expensive than the alternatives.

**Hand-baiting:** Hand-baiting means selective placement of baits under established bait stations, or where active trails or burrows are located. This method makes the most efficient use of baits, but requires the greatest time for distribution. When done properly it is likely to be the most effective method, particularly for pine voles. Teaspoon size, or larger, quantities of bait are placed at each spot, at the rate of 2 to 3 lbs. per acre. Some anticoagulant bait labels specify certain minimum amounts for each placement. To greatly speed bait placement, bait stations, such as asphalt roofing shingles or split tires should be distributed beneath the trees in sodded areas well in advance of baiting time. Over a period of weeks or months, voles develop trails under these bait stations, trails that can be quickly baited after harvest.

Split tires are available in some areas from landfill operators. Split tires have the advantage of permitting bait to be placed in a shallow cup, under the tire so that bait does not readily deteriorate. T-tube bait stations can be made from 1.5 inch diameter PVC pipe. They are placed upright, held by a stake or tied to a tree trunk. A can placed over the upright top keeps out light and rain, and allows baiting after snow has fallen. Be sure to check rodenticide label, to be sure it is allowed. Some labels have a very specific definition of bait stations.

**Retreatment with baits:** Where some voles have survived a rodenticide treatment after being sickened, acceptance of the same bait a second time within a few weeks will be poor. This seems to be a problem more with zinc phosphide baits than with anticoagulants. There are two ways of minimizing this problem: 1) do everything possible to favor nearly complete control with the first treatment; and 2) if a second treatment is needed, and another type of rodenticide is legal in your state, then use the different type for the second application.