

Limit the amount of shelter available. Keep floors free of piled boxes and other material. Store things a foot above the floor, leaving no place that can't be readily cleaned. Outside, keep crawl space under buildings open and clean. Don't pile lumber or other materials against the side of a building. Use sawhorses or other above-the-ground platforms. Eliminate rubbish heaps.

Limit the water supply as much as possible. Fix leaky faucets, tanks, etc.

In working with rat-proofing materials, use at least 2 inches of concrete if it is reinforced; 3 3/4 inches if not reinforced. Galvanized sheet metal should be 24 gauge or heavier; perforated sheet metal or grills, 14 gauge.

Wire mesh or hardware cloth should be at least 19 gauge, and openings no larger than 1/2 by 1/2 inch. If aluminum sheeting is used, it should be 22 gauge for frames and flashing; 20 gauge for kickplates; 18 gauge for guards.

### *Reasons for Failure*

The most frequent causes of failure in farm rat control are either the use of an incomplete program or the use of improper materials. Baiting can't do the job alone; it takes baiting *plus* cleanup *plus* mechanical exclusion. And even the best baits are useless if not used in proper amounts. Many farmers make the mistake of buying one "household" size (1 pound) box of bait to handle the whole farm. He needs to provide all the bait the rats will eat for as long as they will eat it. Then he needs to keep some out for new rats migrating in.

It's often said that the farmer who pays for control can have it. The farmer who doesn't pay for control will pay much more.

## ***Meadow Mice***

The short-tailed meadow mouse (*Microtus* spp.) causes considerable damage to fruit trees throughout the orchard regions of Washington. Meadow mice damage trees by chewing and peeling bark from tree roots and trunks near ground level, often girdling them. This causes reduced tree vigor and fruit yield and may cause the death of the tree. Injuries caused by meadow mice can make trees more susceptible to attack by insects or disease organisms.

Damage to trees is usually more severe during winter under a cover of snow or litter that has accumulated at the base of the tree. In alfalfa, grass, or grain fields, meadow mice will form networks of runways which are mostly concealed by overhanging foliage. These runways cut through the vegetation and connect with subterranean burrows through the sod and among plant roots. Meadow mice feed on plant roots and stems.

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To properly evaluate a meadow mouse problem, the orchardist should inspect areas around the bases of trees and in grassy field borders. Mouse presence may be determined by their narrow runways through the grass, and the small piles of brownish droppings and short grass clippings scattered along them. Another indication is trunk- or root-girdling at or just below the ground level.

The most effective means of obtaining a mouse-free orchard is year-round grass and weed control. This means application of weed control chemicals combined with frequent cultivations and/or grass clipping in both the orchard and surrounding borders. Often, this is neither economical nor feasible. Due to the use of grass cover crops in orchards, the possibility of damage to trees by mice has increased.

### **Description**

Meadow mice are medium-sized, stout (1.5-2.0 oz.), with small, black, beadlike eyes and small, fur-covered ears. The tail is short (one-third of head and body length) and well-covered with hair. The fur is loose, rather long, blackish to grayish or yellowish brown, and heavily interspersed with black guard hairs resulting in a grizzled appearance. The fur is darkest on the back and shades into gray, ashy, or buffy on the underparts. The feet do not have black guard hairs. The tail is dusty-colored above, slightly paler below.

### **Breeding Habits**

Meadow mice are very prolific as they breed several times a year and produce litters of up to eleven young each, with six being the average. The female is sexually mature at four weeks of age and may have as many as eight to ten litters per year. The gestation period is twenty-one days, and litters may follow each other at twenty-five day intervals.

At this rate, when conditions are favorable, mouse numbers can increase markedly in a short period of time, and population increase can occur so rapidly as to suggest an invasion. It is not surprising to have an orchard or field seem relatively mouse-free one season and be heavily infested the following season. One breeding pair of mice can produce up to 3,000 offspring in eight months.

Mouse populations are cyclic with peaks occurring approximately every four years. At peak population levels there may be as many as one to three thousand mice per acre. Each mouse consumes enough forage to equal its body weight each day.

### **Natural Enemies**

Meadow mice have a host of natural enemies, including hawks, owls, shrikes, snakes, badgers, and skunks. These should be protected whenever possible.

### **Control**

Before initiating any pest control measure, the grower should be absolutely certain his actions are necessary and should be sure to consider all alternatives. The following factors should be evaluated:

1. The amount of damage that has already occurred.
2. Damage anticipated to occur without control.
3. Benefits of control versus cost.
4. The effect of a control program on nontarget animals and the environment.

### **Poison Baiting**

**Hand baiting.** Hand baiting is the most flexible method. It is particularly well-suited to areas where soils or soil-moisture conditions are not suitable for mechanical trail building. It is also well-suited for supplemental baiting during the winter when the ground is frozen or covered with snow, and at various times of the year when evidence of mouse activity is noted in small areas.

For fall baiting use the zinc phosphide treated prepared bait. For winter and spring baiting, zinc phosphide-treated fruit cubes, primarily apples are preferred where available.

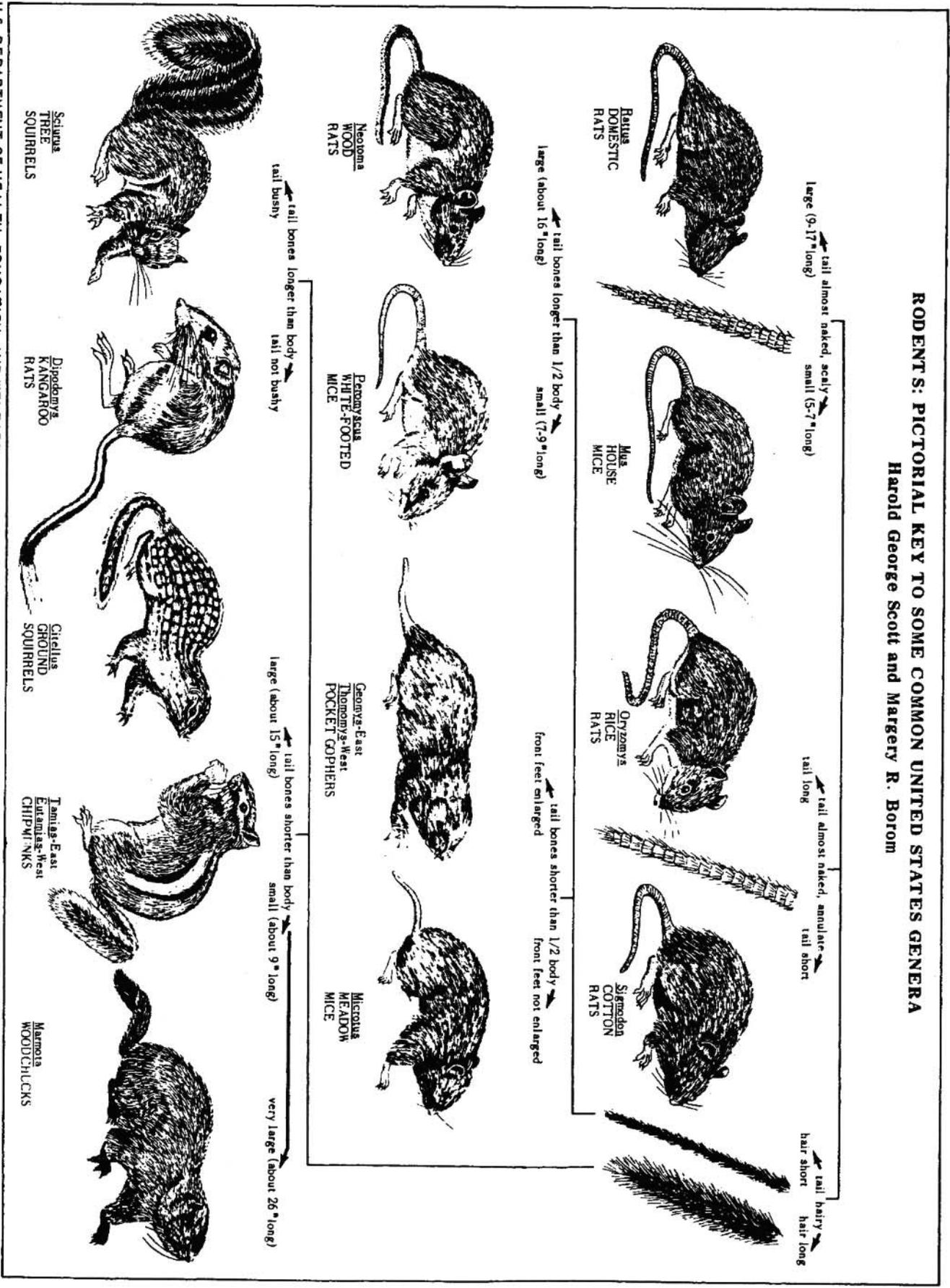
**Mechanical baiting.** Mechanical baiting with a mouse trail builder is a fast, safe, and economical method of control. Mechanical baiting is especially well-suited for large orchards or other large areas. Prepared strychnine and zinc phosphide treated baits are recommended. Apply at the specified labeled rate within burrows at 2" to 4" in depth. A single trail should be made on each side of the trees as close to the trunks as possible and along the orchard borders or as required in other crops or adjoining areas. The soil should be moist enough so that the artificial runways will remain intact until the mice contact the bait through the intersecting natural runways. The ground should not be disturbed for several days following application.

Anticoagulant pellets such as Ramik Brown and Rozol are in wide use for control of *Microtus* sp in orchards after the fruit has been harvested. The pellets are mechanically applied to orchard ground cover. For specific uses refer to Extension Bulletin 419, *Spray Guide for Tree Fruits in Eastern Washington*.

### **Rozol Ground Sprays**

Rozol Ground Spray Concentrate (chlorophacinone) is registered for use in apple, pear, and stone fruit orchards in Washington. This is an anticoagulant which kills only with repeated exposure in ground cover crops for a few days. Use 1 pint of Rozol concentrate per 100 gallons of water with 600 gallons per acre (6 pints concentrate per acre of treated ground). Where there is bare soil, apply only to adjoining ground cover. Apply late in the afternoon for best results.

**RODENTS: PICTORIAL KEY TO SOME COMMON UNITED STATES GENERA**  
 Harold George Scott and Margery R. Borom



## ***Pocket Gophers***

Pocket gophers cause extensive damage to farmers' crops and orchards, as well as being a plague to homeowners and landscape gardeners who desire to maintain well-manicured lawns and well-kept flower beds. These rodents thrive on semideserts, plains, on fairly high mountain slopes, and mesas, as well as in rather humid areas with moist soils.

### **Description**

Pocket gophers are stout-bodied and short-legged with blunt heads. They have prominent, yellow incisor teeth and large, deep, fur-lined, external cheek pouches in which food is carried. The fur-lined (pocketlike) pouches are where the animal gets its name (Fig. 1).

They have brownish coats; small eyes and ears; short, nearly naked tails; and long claws on the front feet. The head and body usually measure 6 to 8 inches; the tail is 3 to 4 inches long.

### **Habits**

The pocket gopher is strictly an inhabitant of the soil, living in burrows of its own construction, never climbing, and only seldom coming out on the surface of the ground.

These animals dig extensive tunnels or runways, which may extend as much as 800 feet and cover an acre of ground. Burrows vary from 2 to 4 inches in diameter. These are more or less parallel with the ground surface, usually at depths of from 6 to 14 inches, but deeper in places. The soil from these tunnels is pushed out on the surface through short, lateral tunnels made at frequent intervals (or forced into abandoned tunnels). This results in a series of rounded surface mounds which, by their position, usually give a clue to the location of the gopher's main tunnel. When putting soil out of a lateral tunnel, the gopher pushes the loads of soil into a more or less crescent-shaped pattern, and when the lateral is closed, a central depression in the mound usually indicates the location of the mouth of the lateral. Mounds are usually found in clusters and one gopher may produce 100 or more in a season.

Fresh mounds are often dark because of the moisture in the soil that has been recently pushed out. Any grasses or herbs covered over by a mound are blanched (by loss of chlorophyll) after a few days, which provides another indication of its age. Most mounds are made in late summer and fall when gophers are digging shallow burrows to get roots for winter, unless conditions are quite dry.

Gophers also make short, almost vertical, laterals in coming to feed on surface vegetation. These often are closed with earth that does not rise above the adjacent ground surface.

Gophers dig deeper tunnels in connection with their nests, and may dig short, steeply pitched "sumps," possibly to drain adjacent tunnels. The nest is usually in a chamber about 8 inches in diameter; it is constructed of fibers of grasses and other plants, shredded like fine excelsior. Food is often stored beside the nest or in other enlarged chambers of the tunnel system.

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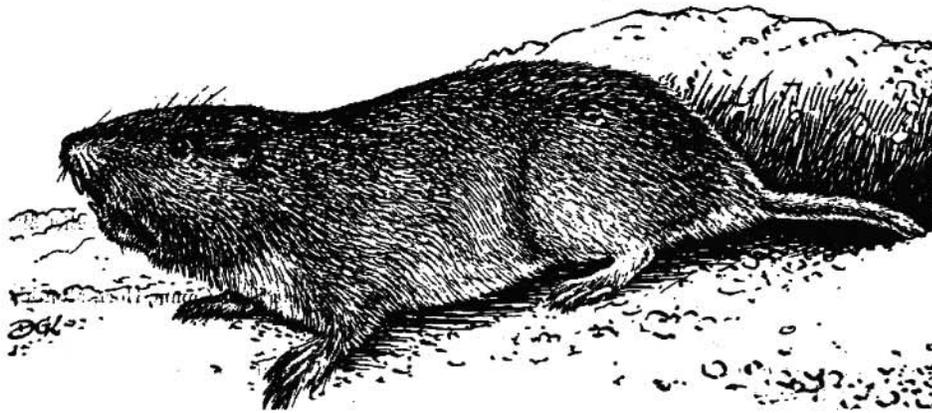


Figure 1. Pocket gopher

Tunnel systems are usually occupied by a single gopher, although young may remain in the tunnel occupied by the mother for a time after leaving the nest. The system of adjacent gophers may be connected, but connecting tunnels and even portions of the workings of a single animal are often firmly plugged with soil. When a gopher is trapped out of a tunnel system, another animal may later move into and occupy that system. Moles or mice occasionally use gopher burrows. Pocket gophers are active throughout the year (even in the higher mountain areas, where they work beneath the snow and put the surplus soil into tunnels in the snow), and fresh workings may be found in any month. Surface activity is less on dry areas during the hot summer months; at this season new mounds may be entirely lacking on nonirrigated lands of the interior valleys. The animals are also less active during and just after heavy rains.

#### DAMAGE

Production in alfalfa fields can be seriously reduced by destruction of root crowns. Gophers damage truck plants by eating the roots. In flower gardens, valuable plants, especially those with bulbous roots, are often destroyed. Gophers cut roots of trees and vines and gnaw the bark of trees, at times completely girdling them so that they die unless saved by bridge grafts. Burrows in home gardens will often divert the relatively expensive metered water. Burrows in the banks of ditches and canals may lead to breaks in the earthwork through which water is lost and adjacent lands are flooded, making expensive repairs necessary.

The pocket gopher is gaining recognition as one of the most important factors in successful ponderosa pine forest regeneration. Pine is apparently one of the gopher's preferred foods, and although there may be an abundance of its natural food on the area, it will seek out the young trees. Because of its subterranean nature and the sometimes limited amount of surface sign, the damage caused by this animal is often unnoticed on a plantation until crowns turn brown during the summer. Occasionally trees will tip at odd angles and may be pulled up easily—roots completely eaten off. During the winter season, they do considerable feeding on the surface under snow cover. At this time, they will gnaw the bark from trees up to an inch or more in diameter. The damage may extend from the roots to about a foot above ground. This above-ground stem barking may be distinguished from porcupine barking by the size of the incisor grooves. Supplemental field signs, such as mounds and earth casts from winter snow tunnels, are good indicators of pocket gopher activity.

On wild land, gophers may be beneficial in the long run. Pasture lands cleared of them often show an immediate increase in the amount of forage available for livestock, but it is unknown whether this would continue for a series of years on unplowed land. Gophers "cultivate" the soil, often turning over large portions of the surface in a single year. Whether their burrowings contribute to or serve to check erosion on slopes probably depends upon local conditions. The rich sediments of valley bottom lands have resulted from erosion at higher elevations in past geologic times; to this process pocket gophers may have been a contributing factor.

### **Breeding Period**

On pasture lands and on uncultivated and nonirrigated areas there is evidently a limited breeding season some time after the beginning of the spring rains, when green forage becomes available in quantity. On such areas there is probably a single, annual brood. But in irrigated regions, especially in alfalfa fields where green forage is always available, breeding occurs throughout the year. In such places, a female may bear up to 3 litters per year. The average litter is between 5 and 6, but may vary from 1 to 13.

The young remain in the nest for several weeks after birth, but eventually leave the parent tunnel system for an independent existence. They often wander some distance overland and start their tunnels in new places. Adults also sometimes move overland. Gardens and fields earlier free from gophers thus may become inhabited by young in the late spring or summer.

### **Moles or Gophers**

The two species of mammals are compared here because they have a good deal in common, and it should be determined which is being dealt with in seeking control measures.

The key to identification is the mound. The mole mound is somewhat conical and not much over a foot in diameter. The hole is not evident when you look at the mound. Push the soil aside and you will find it under the center of the mound. Each mound is connected with another in a line by the moles' runway system.

The gopher mound fans out from a hole near one edge of the mound. This hole remains plugged while the gopher is in his runway system. The gopher mound is relatively flat compared to the mole mound. Gopher mounds vary from about 1 to 3 feet in diameter and 4 to 8 inches in height. Some of the smaller species merely plug the hole, leaving no mound. Several mounds will often be found grouped together. They are not regularly found in a line as are mole mounds.

Soil in a gopher mound is usually quite fine. A mole mound will often be more cloddy. Gopher runways and holes to runways vary from about 1 to 4 inches in diameter. Mole runways are seldom over 2 inches in diameter.

### **Methods of Control**

Pocket gophers may be controlled effectively and even eliminated over rather large areas if a person uses care and is persistent. Control measures may be taken during any season. Upon first

evidence of pocket gopher activity in garden areas, control measures should be taken. This oftentimes save many valuable plants. The most desirable time to employ control measures is prior to when the young are born. Every female caught means fewer pocket gophers in the future.

Control operations can best be conducted during the seasons when the pocket gophers are most active near the surface. This is usually indicated by the presence of fresh mounds of dirt. At other times, labor and material may be wasted in treating unoccupied systems of runways. During the fall, when pocket gophers are usually most active, control operations also can be carried on with the least interference to growing crops.

Trapping and hand placement of toxic baits are used to control pocket gophers in small areas, whereas larger areas can be protected by use of mechanized equipment which properly places the control agent.

### TRAPPING

The traps normally used for rats, mice, and larger mammals are not suitable for pocket gopher control in that they must be caught in their burrows where space is limited. Several pocket gopher traps have been designed (Fig. 2) and are of two types: those designed to spring when a pocket gopher pushes against the flat trigger pan of the trap, and those activated by a trigger, which operates by the pocket gopher seizing the special bait.

Trapping is especially useful in gardens, orchards, small fields, and the banks of irrigation canals. It is as effective as any other control method. The traps which have been designed for pocket gopher control are safe to handle and use and require little skill and effort to place properly.

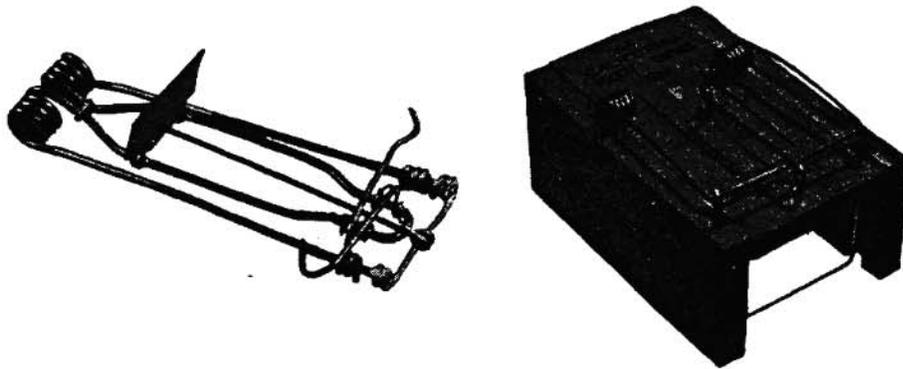


Figure 2. Traps for pocket gophers, shown as set for use. Left, Macabee trap; right, California pocket gopher trap of wood.

A commonly used trap is the Macabee-type spring trap, which is available through most hardware and farm supply stores. It is about 5 1/2 inches long and constructed of wire except for the trigger. Another popular trap is the box type, which has a choker effect.

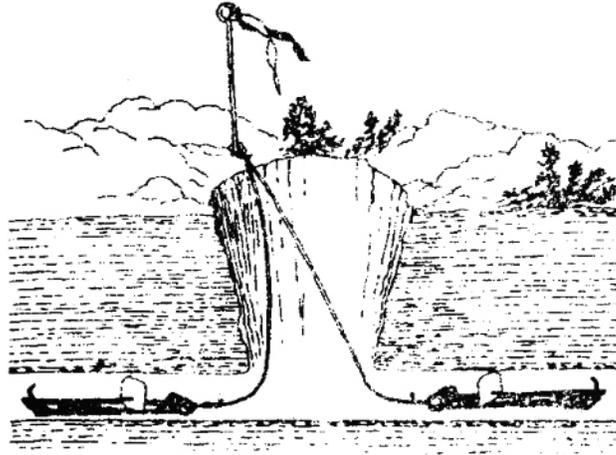


Figure 3. Proper way to set two traps in main runway.

The best placement of the Macabee trap is in the main runway, not in the lateral runways which lead to the surface mounds. Two traps should be used for each setting, one in each direction (Fig. 3). A shovel serves for digging down to the main run. A probe (Fig. 4) is useful in finding the main run. Proper location is determined by probing into the soil 12-18 inches back from the mound on the side where the horseshoelike depression is found. A stout garden trowel or shovel is needed to dig an opening into the main runway to insert the traps. Another method of locating the main runway and inserting traps is to scrape the dirt from a fresh mound until a round circle of fresh dirt is found plugging the lateral runway. Dig down the lateral to the main runway and place two traps back-to-back. Traps can be used in lateral runs by removing the soil plug and placing one trap with the claws away from the opening in the hole. However, this technique does not bring the success that the two-trap method does.

In probing, open runways can be found quite easily in that the probe will readily drop through the opening. If the runway is loosely filled with soil, the drop will be less noticeable but still plainly felt. If it is lightly plugged, dig down a short distance with a shovel and probe again. If this fails, a new mound should be used.

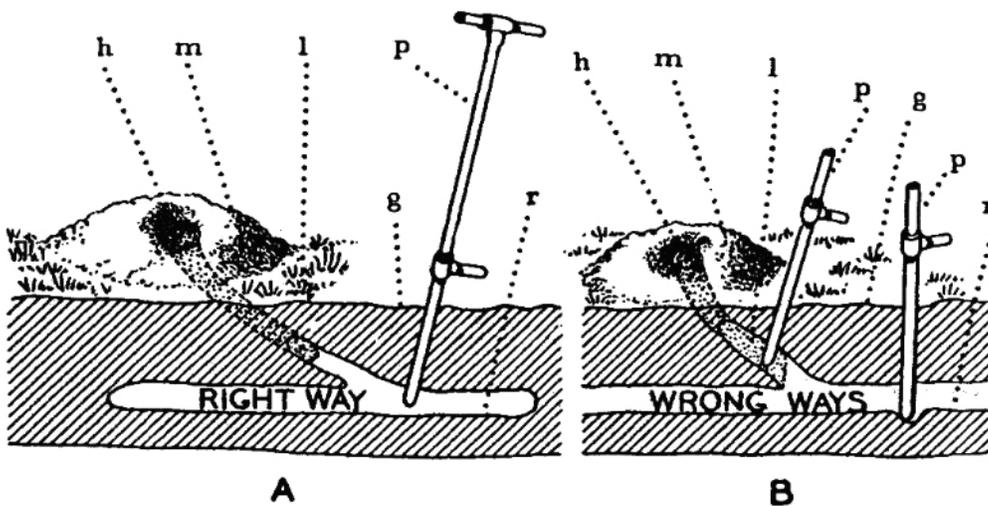


Figure 4. Right and wrong way of using runway probe. *h*, horseshoelike depression; *m*, mound; *l*, lateral runway; *p*, probe; *g*, ground surface; *r*, main runway.

### **How to Set Traps**

When the main runway is located, dig it out so that a trap can be set in each direction. Clear out the runway with a spoon or by hand with as little disturbance as possible. Set the treadle, or pan, so that the trap can be sprung with a light touch. **DO NOT TEST THE TRAP BY HAND.** Place the jaws forward, well into the hole. A small amount of loose dirt may be left in the bottom of the tunnel to cover the prongs and front end of the trap when it is pushed into place. Press the trap down firmly so that it will not slide backward if a gopher pushes against it. Cover the hole into the burrow with a clod or vegetation so that light will not penetrate into the burrow system. Pocket gophers will close all open burrows very lightly to keep natural enemies from entering. Traps which are set and the holes left uncovered may be sprung by the soil which the gopher pushes ahead to plug the hole.

Attach to each trap a light wire or cord that can be fastened to a stake or other object to mark its location. This also prevents the loss of traps by wounded gophers dropping traps back into the burrows or by predatory animals taking traps with gophers in them. The use of conspicuous stakes is quite helpful in marking the locations of traps in alfalfa fields, truck patches, and other areas where vegetation is dense and/or tall. Traps are easily lost if not marked in such a manner. On farms or ranches, distinctive stakes enable employees to recognize gopher sets. For the most efficient use and best results, each setting should be checked each morning and evening, or even more often if possible.

When traps have been placed and set, tramp down or level the tops of mounds so that on future visits to the area it will be easy to determine where gophers remain and whether further effort is needed.

### **Poison Baits**

The use of some poisons has been prohibited by law and others are for use only by licensed pest-control operators. Therefore, investigate local, state, and federal laws as to the use of poisons. All poison baits should be used with a great deal of care.

Pocket gophers may be killed in numbers by use of poison baits. However, their external cheek pouches or pockets are lined with fur and poisons are not readily absorbed through this lining. Because of this, dependence must be placed on stomach poisonings. There are commercial baits available for this purpose. The baits must be of some material that is desirable and must be placed in the main runways with as little disturbance as possible. Baits which are placed above ground are not often taken by gophers and are a menace to other wild or domestic animals. If baits are placed in the lateral runs or in open holes, they may be buried or pushed out by the gopher's activity. Some grains, such as corn, oats, barley, wheat, and grain sorghum are commonly used for baits. The gopher must consume grain baits to be poisoned. The most commonly used baits are prepared strychnine bait pellets or grain. In addition, 1080 grain baits have proved very effective where registered and applied by pest control operators.