

Rodents and Their Control

Domestic rodents constitute a major pest problem in structures. There are three major domestic rodents in the United States: the house mouse, *Mus musculus*; the Norway (brown or sewer) rat, *Rattus norvegicus*; and the roof (black or ship) rat *Rattus rattus*. A field key that will aid you in identification of domestic rodents is presented in Figure 20. Rats and mice eat almost everything man or livestock use as food. Rats contaminate much more with their urine, hair, feces and other filth than they eat, with the result that such products must be destroyed. Before you can control rodents, it is important you know the behavior patterns and identify the correct species.

Senses, Agility and Reactions of Rodents

Touch

A rodent's sense of touch is well developed in highly sensitive whiskers or vibrissae, and certain guard (tactile) hairs. Rats and mice prefer to run along walls or between things where they can keep their whiskers in contact with side surfaces.

Vision

Their vision is not too well developed. Apparently they are colorblind, so any distinctive coloring of poison baits does not reduce their acceptance as long as the dye is tasteless.

Smell

A rodent's ability to smell is keen. Rodents apparently like the odors of most foods eaten by humans. They are accustomed to the smell of humans, so human odor on baits and traps does not repel them.

Taste

A rodent's tasting capabilities are highly developed. Rats associate sickness caused by poison bait with the bait and not the poison. They prefer fresh food to stale or spoiled food.

Hearing

Rodents have a keen sense of hearing. They can locate the source of a noise within 6 inches. Unusual noises cause rodents to attempt escape.

Balance

Their sense of balance is excellent. A falling rodent always lands on its feet. The roof rat even maintains its balance well while walking on suspended wires.

Reaction to Strange Objects

Rats may avoid a new sound or a strange object in their environment for three or more days, particularly if their associates are alarmed by it. Other objects are readily accepted by them (examples: food, garbage). As rodent population pressures build, all of the rats may develop a fright reaction to disturbances. Mice are more likely to explore new objects and to be caught in newly set traps.

Climbing

Roof rats and house mice are good climbers, and the Norway rat can climb quite well when necessary.

Jumping and Reaching

Rats can jump nearly 2 feet vertically and 3 feet with a running start; they can jump 4 feet horizontally and 8 feet from an elevation that is 15 feet above the finish point. Rats can reach upward about 13 inches.

Swimming

Rodents are good swimmers. They are able to swim up through floor drains and toilet bowl traps.

Recognizing Rat and Mouse Signs

Rats and mice are habitually nocturnal and secretive and are rarely seen during the day except when infestations are heavy. Therefore, it is necessary to interpret signs of their activities properly in order to plan control work. These signs are found in secluded places, such as along walls, under piles of rubbish and behind or under boxes, boards and thick vegetation. From the rodent signs, one can tell the species present and whether a rodent infestation is current or old, heavy or light. This information is critical for designing your rodent control plan.

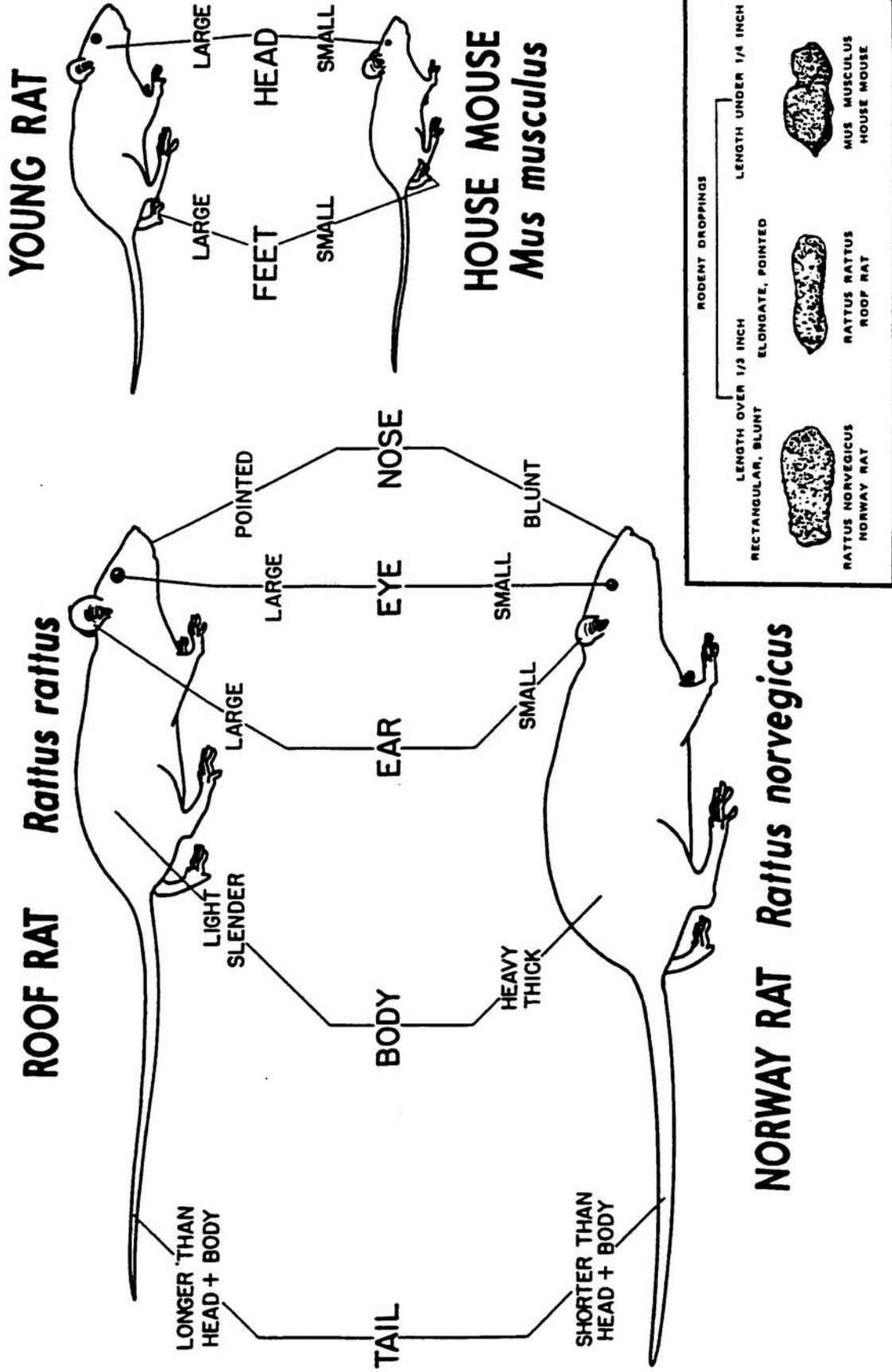


Figure 20. Field key to domestic rodents.

Droppings

Fresh fecal droppings are usually moist, soft, shiny and dark, but in a few days they become dry and hard. Old droppings are dull and grayish and crumble when pressed with a stick.

Runways

Rats habitually use the same runways between food, water and harborage. Because of the keenly developed sense of touch in their vibrissae (whiskers) and in specialized hairs along the body, rats prefer continual body contact with at least one vertical surface, such as a fence or wall. Rats also follow “odor trails.” Outdoors, their runways are narrow pathways of beaten earth swept clear of debris. Indoors, greasy runways are found along walls, steps and rafters. Undisturbed cobwebs and dust in a runway indicate that it is not in use.

Rubmarks

Along regularly traveled runways, a dark, greasy mark forms from contact with the rodent’s body. Fresh marks are soft and will smear if rubbed. As the grease ages, it dries and gathers dust and will flake off when scratched with a fingernail. The rubmarks of the Norway rat are most commonly found along runways near ground or floor level, while those made by the roof rat are most commonly seen overhead as swing marks beneath beams or rafters at the point where they connect to the walls. Mice do not leave detectable rubmarks except when the infestation is heavy.

Burrows

The Norway rat prefers burrows for nesting and harborage; the roof rat burrows only occasionally. Burrows are found in earth banks, along walls, under rubbish or concrete slabs and in similar places. If a burrow is in use, its entrance will be free of cobwebs and dust. Fresh rubmarks on hard-packed soil and the openings indicate a well established and presently used burrow. The presence of fresh fragments of food or freshly dug earth at these burrow entrances also indicates current use by rats.

Tracks

Fresh tracks are sharp and distinct, whereas old tracks are covered with dust and

are therefore less distinct. The tracks of the five-toed rear paws are more commonly observed than are those of the four-toed front paws, but both may be present. To detect rodent activity, place patches of any dust material, such as flour or talc, along runways and check for tracks. To see tracks in the dust, hold a flashlight at an angle that causes the tracks to cast distinct shadows. Tail marks, too, are often visible in dust or tracking patches.

Urine

Dried rodent urine will fluoresce bluish white to yellowish white when illuminated with a blacklight. Be aware, however, that numerous items will fluoresce under a blacklight including optical bleaches found in many detergents and lubricating oils. For positive identification, use a Brom Thymol Blue Urease Test. Place the suspected material on Urease-Brom Thymol-Blue test paper. Moisten with water and place a cover glass over the testing area. If a bluish spot appears after three to five minutes, it is urine.

Rodent Management

Commensal rodents can cause considerable damage to stored grain and structures. If rats or mice are present in and around such facilities, it is because they are able to find food, water (in the case of rats), places to hide and places to nest and rear their young. Good sanitation practices, combined with steps to prevent rodent entry into structures and the elimination of rodent harborage, will reduce rodent problems. While sanitation and rodent-proofing may not eliminate rodents, they will limit the size of rat or mice populations the premise can support.

Sanitation and Habitat Modification

Clean, orderly facilities will not support large numbers of rodents. Attention to key elements that rodents require for survival, **food** and **shelter**, is important in limiting the habitat’s carrying capacity for these species. Sanitation involves good housekeeping, including proper storage and handling of food materials. Warehouses, processing areas, packing areas and similar structures may provide excellent habitat for commensal rodents. Finished products should be stored in rodent-proof structures whenever possible.

Shelter is an invitation for a rodent problem (especially when shelter is near a food source). Particularly when structures are not rodent-proof, it may be difficult to prevent rodents from feeding on food products; however, it is possible to achieve good rodent control by taking away their shelter. When mice and rats are unable to hide or rest, they cannot remain in any location for long. Regular removal of debris and weed control around structures will reduce the amount of shelter available to rodents. In some instances a strip of heavy gravel placed adjacent to building foundations or other structures will reduce rodent burrowing, especially burrowing by Norway rats. Gravel should be at least 1 inch (2.5 cm) in diameter and laid in a band at least 2 feet (0.6 m) wide and 6 inches (15 cm) deep. In any event, keeping the periphery of buildings and other structures clean of weeds and debris (including stacked lumber, firewood and other stored materials) will discourage rodent activity and allow easier detection of rodent signs. Cleaning up also puts rodents under stress. This makes it more likely they will accept lethal quantities of baits (rodenticides) if these are used as part of a control program.

Water sources should be eliminated wherever possible. Rats require water daily for their survival, unless feeding on very moist foods. While house mice can survive without water (obtaining it from their food), they will drink when water is available. Drainage ditches and water runoff areas must allow water to flow quickly away from structures so no standing water accumulates. Where no sources of water are present, rats cannot thrive. Further, reduction of water sources enhances the effectiveness of liquid rodent baits.

Storage

Food products must be stored properly on commercial premises. Where possible, these materials should be kept in rodent-proof containers or rooms. Sacked foods should be kept in orderly piles, preferably on pallets so they can be readily moved. An 18-inch (45 cm) strip of light-colored paint should be painted on the floor around the base of the walls in the warehouse. Warehouse personnel should not pile supplies against the walls on top of these strips. This permits easier inspection and treatment in rodent control work. Intersecting stored products with frequent aisles and daily sweeping or vacuuming of spilled foods should be routine. Promoting these practices is the only chance of achieving some degree of control

in a warehouse that cannot be economically rodent-proofed and is under constant rodent pressure from the surrounding area.

Nonfood supplies such as boxes, machinery, sacked goods, lumber, building supplies, etc., should be stacked away from the walls and kept off the ground to aid access to the area. These need to be inspected for rodent infestation as frequently as the food stores.

Reduction of outdoor harborage around the premises will assist in relieving the constant pressure from outside rodent populations. Racks should hold stacked lumber, building supplies, rubbish, etc., at least 18 inches (45 cm) off the ground. Other outdoor harborage such as weeds, brush and junk piles should be trimmed or removed.

Sources of water should be dried up and the cause eliminated by repairing leaky faucets and plumbing, draining standing water or covering open water supplies that cannot be handled any other way.

Rodent-Proof Construction

Where rodents cannot enter structures, they cannot cause damage to products stored inside them or damage the structures themselves. Ideally, all structures where food products are stored or processed should be rodent-proof. To prevent rodent entry, the physical capabilities of rats and mice must be understood. For example, rats and mice can:

- Run along or climb electrical wires, ropes, cables, vines, shrubs and trees to gain entry to a building.
- Climb almost any rough vertical surface such as wood, brick, concrete and weathered sheet metal.
- Crawl horizontally along pipes, augers, conveyors or conduit.
- Gnaw through a wide variety of materials including lead and aluminum sheeting, wood, rubber, vinyl and cinder block.

In addition, rats can:

- Climb the outside of vertical pipes and conduits up to 3 inches in diameter; climb the outside of larger pipes attached to buildings by bracing themselves against the wall; climb the inside of vertical pipes between 1 1/2 and 4 inches (3.8 and 10.2 cm) in diameter.
- Jump from a flat surface up to 36 inches (91 cm) vertically and as far as 48 inches horizontally.

- Drop 50 feet (15 m) without being seriously injured.
- Burrow straight down into the soil for at least 36 inches (91 cm).
- Reach as high as 13 inches (33 cm) along vertical walls.
- Swim as far as 1/2 mile (800 m) in open water, dive through water traps in plumbing and travel in sewer lines against a substantial water current.

House mice can:

- Jump as high as 18 inches (46 cm) from a floor onto an elevated surface
- Travel considerable distances hanging upside down from screen wire.

As mentioned above, rats can enter openings larger than 1/2 inch (1.27 cm) while mice can penetrate openings over 1/4 inch (6 mm). Although these are small openings, any place a young animal can squeeze its skull through, the rest of the body can generally follow.

The location of the openings is equally important. A rule of thumb for rats is that all openings 39 inches (1 m) **above and below** grade level should be blocked. Grade level means not only the height above ground line but also above any objects such as sheds or stored materials the animals can easily climb on to reach an opening. Norway rats have been known to get into upper storage, particularly where vines, fire escapes and other vertical “ladders” are available. Roof rats tend to inhabit attics and the upper levels of structures. Additional measures may be necessary to block entry near pipes or electric wire openings.

The next consideration is the use of rodent-resistant materials. Stuffing a wooden block in a hole is about as effective as newspaper. The following materials are rodent-resistant.

Stainless steel wool	No specific weight or density.
Sheet metal	26-gauge or heavier, galvanized.
Perforated metal	24-gauge or heavier of rust-resistant materials with openings no more than 1/4 inch (6 mm).
Hardware cloth	19-gauge or heavier with rust-resistant coating and openings no more than 1/2 inch (13 mm) for rats and 24-gauge with 1/4 inch (6 mm) for mice.
Brick	Regular size 3 3/4 inches (10 cm) with mortared joints.

Cement mortar	Should be 1:3 mixture or richer.
Concrete	Should be 1:2:4 mixture or richer and 4 inches (10 cm) thick.

Hardness is not the only consideration, however. The shape and position of the material is also important in determining if a material will be attacked. Rodents cannot work on smooth surfaces, seeking instead a “gnawing edge” such as a joint, butt, small hole or other irregularity where they can get a better bite.

There are a multitude of devices and situations encountered in rodent-proofing a given structure. The main points to consider are listed on the following pages.

Doors

Like humans, rats find the easiest entrances are doors. Tight-fitting doors with a sill clearance of less than 3/8 inch (1 cm) prevent most rats from entering if doors are kept closed. Self-closing devices may be useful in preventing human carelessness. Doors with higher clearances should have metal channels or butt plates installed.

Windows

The next logical openings are windows that are within reach of rats. Windows left open at night are particularly vulnerable. Mosquito screens will probably prevent entry, but heavier screening with 1/4-inch (6mm) hardware cloth is recommended. When attached to wooden framing, the metal wire should be wrapped around the edge of the frame. Windows that swing out horizontally need be protected with a basket device. Windows that do not need to be opened should be nailed shut and any broken glass repaired.

Vents and Drainpipes

Vents that are accessible to rats should be screened in the same manner as windows. Be aware that 1/4-inch mesh hardware cloth reduces ventilation efficiency and may even freeze completely over in severe winter storms. This could create a potentially dangerous situation leading to a lack of air circulation and suffocation in some structures (for example, livestock or poultry confinement structures). Roof vents do not normally need rat-proofing except where roof rat invasions are a threat. All utility and service openings into the basement should be

inspected and closed. Drainpipes in particular should be screened and kept in good repair, as this is a favorite entryway. Where rats climb up sewer pipes and into toilet bowls, a rat guard can be installed. A piece of pipe 8 inches (20 cm) in diameter and approximately 30 inches (76 cm) long is placed into a vertical sewer pipe to prevent rats from entering.

It seems to be part of the steam fitters' code that a one-foot hole must be knocked in the wall to place a one-inch pipe, a two foot hole for a two-inch pipe, etc., and to leave these open for when they are called back for repairs. These openings must be sealed with cement or sheet metal. Small holes can be tightly packed with coarse steel wool.

Foundations and Basements

Norway rats generally enter through basements. Holes and cracks in foundation walls and basement floors must be blocked. In rat-infested locations, put hardware cloth, sheet metal or broken glass in large openings before sealing with concrete. This gives the concrete time to harden before rats chew through the uncured concrete.

Where foundation entries cannot be completely blocked or a dirt floor exists, a curtain wall can be built. A rat that burrows down to the bottom of the "L" will travel along the base rather than digging outside the leg of the "L." While "L" type is recommended, some authorities recommend a straight 36 inch (1 m) wall can be just as effective in keeping out rodents and is cheaper to install.

Outside Utility Lines

Roof rats travel along utility lines where they can gain entry into structures. Guards with a 18-inch (45 cm) radius are needed to interrupt the free passage of these expert wirewalkers. They should be placed away from the building so the rats cannot jump over the guard and onto the building. Guards should be constructed of at least 24-gauge metal. Nails should be spaced far enough apart so as not to provide footing for the rats.

Loading Docks

These areas may offer harborage for rodents, plus provide very easy access to a building. Keep docks clean of all debris and other shelter for rodents.

Interior Rodent-Proofing

Double walls are attractive rat passageways. Eliminate them wherever possible, or place stops of galvanized sheet metal or concrete. Cement floors are recommended, particularly in food-handling establishments. Other types of flooring should be inspected and rat-resistant flooring should be used to seal off openings in the floors. Stairwells should be blocked off completely or left wide open. In multiuse buildings, seal the interior passageways around any food-handling section.

Inspection

After installing rodent proofing in structures, keep close watch of these structures for about two weeks, as pressure to break through new rodent-proofing is particularly heavy following its installation. Also, begin a trapping or baiting program to completely eliminate rodents trapped inside by the proofing. The effectiveness of stoppage is only as good as its maintenance. Frequent inspections and prompt repair of any breaks is a necessary part of the overall rodent program. The following items should be checked on the exterior:

- Doors, windows and vents
- Weeds and other vegetative harborage
- Old equipment, pallets, boxes, etc., stored against the building
- Cracks and holes in building
- Loading docks
- Utility openings in exterior walls

The interior should be checked for:

- Floor and drain caps that are tightly sealed
- Pipe and other utility line openings in interior walls and floors
- Holes and cracks in expansion joints
- Sources of food, water and harborage

A repair kit for rodent-proofing and its maintenance should include hammer, pliers, tin snips, 1- and 1 1/2-inch masonry nails, assorted wood nails and staples, odd cuts of galvanized tin, odd cuts of 1/4-inch hardware cloth, screwdriver, assorted screws, keyhole or coping saw, ice pick or awl, staple gun, caulking compound, plastic wood, tape measure, concrete mix, bucket, trowel, plaster patching compound, 3M body caulking compound, contact glue, white, epoxy, stainless steel wool, short lengths of wire, wood blocks and dowels.

A building will remain rodent-proof only as long as the protective devices are maintained. Careless breaks in rodent-proofing devices,

thoughtless actions in propping doors or windows open and changes in building construction or plant operations may undo all the previous work. Constant inspection of rodent-proofing devices to prevent leaks is as necessary as plugging up all the holes in a sinking boat.

Tracking Powders

Tracking powder is a toxic dust placed where rodents travel. They pick up the chemical on their feet and fur and ingest the toxicant as they groom themselves or handle food with their forepaws. Tracking powders have been used for a long time. However, many, if not all, are Restricted Use pesticides.

The advantages of tracking powders are:

1. Useful when food is plentiful and bait acceptance is difficult to achieve. Tracking powders reportedly result in no bait shyness or awareness of the toxicant.
2. Usually added to the environment without arousing suspicion of rodents, though some individuals may avoid patches, at least initially.
3. Can increase the effectiveness of a rodent control program when used in combination with other methods, such as spreading around bait and water stations.

The disadvantages of tracking powders are:

1. They cannot be used where there is a hazard of the toxic powder being blown onto food, tracked on food by rodents or applied in areas with constant human traffic and air currents. Dusty and damp locations and scattered straw or other loose materials interfere with the effectiveness of powders.
2. They create a greater hazard than baits because the toxicants in tracking powders are 10 to 40 times the strength found in baits.
3. Powders are usually more expensive to apply.
4. The applicator must accurately locate areas traveled by rodents or the application will be wasted.
5. It is almost impossible to remove the tracking powder completely when cleaning up any premises.

Placement of Tracking Powders

Your choice of placement depends upon circumstances and personal experience, but the overriding consideration should be safety.

Tracking powders can be placed in the following ways:

1. Spread in normal runways between food, water and shelter sources.
2. Placed on an apron and around feeding and watering bait stations in normal feeding areas.
3. Exposed in especially constructed tunnels, runways or stations constructed from round tubes such as the cardboard cores of carpets, PVC pipe or other rolled material. The tunnel should be at least 18 inches (45 cm) long and between 2 to 4 inches (4 to 10 cm) in diameter. It is advisable to place stops of 1/2 inch (1 cm) at the ends of the tunnels to keep the powder from being blown or tracked out. All tracking tunnels should be conspicuously marked with poison labels.
4. Blown into dry burrows or other enclosed spaces.

Different types of powders are available. The powder blown into burrows and double walls can be finer than that placed in the open. Powder should be placed at least 15 feet (5 meters) or more from food supplies. It is also more effective if placed near harborage. The further the animal travels before grooming itself, the less material will remain adhered to the feet and fur. Place powders only at floor level to minimize chances of being blown where they could cause contamination.

Application of Tracking Powders

Powder can be applied with a spoon, duster, salt-and-pepper type shaker, flour sifter or jar with holes punched in the lid. A spoon is used to place dust in tunnels. A duster is recommended for use on burrows or enclosed spaces. In open placements, apply carefully to keep the dust from becoming airborne.

Application should be confined to a given area. A uniform layer of powder should be applied to produce a layer at least 8/100 inch (2 mm) thick. Less powder is less effective, while a layer deeper than 16/100 in. (4 mm) is a waste of material. In all cases, follow label directions.

Powder must be replaced when it becomes caked or diluted with dust, dirt or other extraneous materials. Tracking powders may be used in connection with other controls such as solid or liquid baits. Some suggest scattering baits with powders in patches. Rodents may stop to investigate the food even if they do not eat it. The speed with which they travel across a patch of tracking powder affects the amount they will pick up. Light-colored or highly reflective powders arouse more suspicions than dark-colored dusts. It may be most efficient to lay down tracking patches of nontoxic materials (talc, flour, etc.) to check activity before applying toxic powders.

Tracking powders are most popular for use against house mice, particularly when other methods are not successful. Tracking powders are least effective against the roof rat, which walks with its legs extended and tail carried above the ground in comparison to other species. Furthermore, roof rats spend more time on vertical surfaces and upper structures where powders cannot be used.

Baits and Baiting

In controlling rodents with rodenticides, the selection of a proper bait material is of utmost importance. One reason for the success of commensal rodents is their ability to utilize foods available in a variety of environments. The type of environment as well as physiological requirements and individual preferences of a given rodent population determines the success or failure of a baiting program.

While certain baits are accepted more often than others, there is no "universal bait" that is consistently accepted in all circumstances. Thus, it is necessary to constantly assess baits and remain flexible in shifting techniques to suit a particular situation. Baits can be bought commercially or mixed on your own. Commercial formulations are recommended, as these are governed by regulations that require that operations are safe for their employees. Conversely, baits that you mix can be better accepted by rodents than commercial baits because they are fresher. However, poor quality bait material and inadequate mixing facilities may make it cheaper and more effective to rely on a variety of commercial baits than to mix one's own.

Baits are made of three components: toxicant, food or bait base and usually one or

more additives to assist in compounding an acceptable bait. The choice of toxicant will be dictated by the target species, need for quick or long-term control and safety considerations.

The use of toxic baits, i.e., rodenticides, is recommended when there are large infestations of rodents and there is less concern about odors resulting from decomposing carcasses. Whenever a rodenticide is used, safety must be the first consideration. Toxic baits should be placed where they are inaccessible to children and pets. Rats and mice are colorblind; therefore, dyes that are tasteless to rodents can be used in baits to identify them for reasons of safety.

One classification of rodenticides is anticoagulants (Table 1), which are slow acting, chronic toxicants that require multiple feedings to be effective. Examples of first-generation anticoagulants are warfarin and chlorophacinone. Second-generation anticoagulants (brodifacoum, bromadiolone, and difethialone) can be effective after a single dose, though it may take up to 5 days before death ensues. Roof rats generally require a few more feedings of first-generation anticoagulants than Norway rats to produce death. However, little difference is evident when using second-generation anticoagulants.

Rodents poisoned with anticoagulants die from bleeding internally. A few cases of pet poisoning have been reported when pets feed on dead rodents. Dogs are more sensitive to anticoagulants than are cats, and pets accustomed to feeding on dry foods can easily ingest a toxic dose of rodenticide if these baits are accessible to them. Older, first-generation anticoagulants (e.g., warfarin, diphacinone, chlorophacinone) are considered less hazardous to pets because they typically require multiple feedings to achieve a lethal dose, and accidental poisoning can be treated with an antidote, Vitamin K1. However, the majority of anticoagulants being marketed today (including many d-CON products) contain brodifacoum or other second-generation materials than can be fatal in a single feeding.

Label directions on anticoagulants commonly instruct maintenance of a continuous supply of bait for 15 days or longer until feeding ceases. Anticoagulants are purposefully slow acting to prevent rats from becoming bait-shy. If the bait produces an ill effect in a rat but not death within a few hours, the bait will often

become associated with the illness. Bait shyness can persist for weeks or months and may be transferred to nontoxic foods of similar types.

Bromethalin, cholecalciferol and zinc phosphide are single-dose, nonanticoagulant rodenticides that can be effective for anticoagulant-resistant populations of rodents (Table 2). Although only a single dose is required, both bromethalin and cholecalciferol may take up to four days before death ensues. Because of this slow action, the rodent's subsequent illness is not associated with the bait even if a sublethal dose is consumed; thus,

bait shyness does not usually occur. These baits, in effect, serve as their own prebait.

Zinc phosphide is relatively quick acting, with results evident one-half to 20 hours after ingestion. Because a rat or mouse could potentially ingest a small amount of zinc phosphide and survive, prebaiting is recommended. Prebaiting, that is, training rodents to feed repeatedly on nontoxic bait prior to applying the toxic bait, will encourage rats to feed subsequently on the toxic bait, thus largely preventing sublethal doses and thus bait shyness. As with any product mentioned, be

Table 1. Anticoagulant used for rodent control.

Common name and typical trade names	Chemical name	Usual types of formulations			Restricted Use Pesticide?
		Food bait	Liquid	Tracking powder	
Brodifacoum* (Talon®)	3-[3-(4'-bromo[1,1' biphenyl]-4-yl)-1,2,3,4-tetrahydro-1-naphthalenyl]-4-hydroxy-2H-1-benzopyran-2-one	X			
Bromadiolone* (Maki®, Contrac®)	3-[3-(4'-bromo [1,1'biphenyl]-4-yl)-3-hydroxy-1-phenylpropyl]-4-hydroxy-2H-1-benzopyran-2-one	X			No
Chlorophacinone (RoZol®)	2-[(r-chlorophenyl)phenylacetyl]-1,3-indandione	X		X	Yes for tracking powder
Difethialone* (Generation®)	[(bromo-4'-[biphenyl-1-1']-yl-4) 3-tetrahydro-1,2,3,4-naphthyl-1] 3-hydroxy-4, 2H-1-benzothiopyran-2-one	X	X		No
Diphacinone (Ramik®, Ditrac®)	2-diphenylacetyl-1,3-indandione	X		X	
Warfarin	3- (a-acetonylbenzyl)-4-hydroxycoumarin	X	X		No

*This product is capable of being lethal in a single feeding.

Table 2. Single-dose, non-anticoagulant rodenticides used for rodent control.

Common name and typical trade names	Chemical name	Usual types of formulations			Restricted Use Pesticide?
		Food bait	Liquid	Tracking powder	
Bromethalin (Assault®, Vengeance®)	N-methyl-2,4-dinitro-N-(2,4,5-tribromophenyl)-6-(trifluoromethyl) benzenamine	X	X		No
Cholecalciferol (Vitamin D3, Quintox®, Rampage®)	9,10-Seocholesta-5,7,10 (19)-trein-3 betaol	X			No
Zinc phosphide (Ridall®)	Zinc phosphide	X		X	Yes for tracking powder and other formulations

sure to follow label recommendations to achieve best success. All single dose, non-anticoagulant baits should be removed and destroyed after the end of a poisoning program.

Single-dose, nonanticoagulant rodenticides work in a variety of ways. Bromethalin depresses the central nervous system and results in paralysis. Cholecalciferol, also called Vitamin D3, is a calcium releaser that causes too much calcium to be released into the blood, resulting in kidney, liver or heart failure. The advantage of Vitamin D3 is a minimal risk of secondary poisoning to pets or wildlife that eat poisoned rodents. Zinc phosphide causes gas to enter the circulatory system, resulting in heart paralysis, gastrointestinal damage and liver damage. Many formulations of zinc phosphide are Restricted Use and therefore require an applicator's license to be administered.

Selection of the food base depends upon many factors: species of rodents to be controlled, particle size, taste, texture, odor, caloric content and competitive foods available to the rodents. Rats normally prefer food bases they are accustomed to eating. Mice are nibblers and like to try new foods, but primarily are seed and grain feeders. Norway rats prefer meat and fish, though basically they are grain-eaters. Roof rats prefer seeds, nuts, fruits and vegetables.

Particle size is important. The optimum particle size for Norway and roof rats is about 0.04 inch (0.5 to 1.5 mm). Mice prefer a smaller size.

The effects of texture, taste and odor of bait foods on acceptance are intertwined. Whereas odor helps attract a rodent to bait, the final test of consumption is the palatability of the material determined by its taste and texture. Different varieties as well as different processing procedures of the same food will result in different rates of acceptance.

While rodents seek a stable caloric content in their food intake, this can be influenced by the quantity and quality of other foods available in a given environment.

Rodent food bases can be classified into meats, vegetables, fish, fruits, liquids and grains and seeds. The food preferences listed below are in the order of acceptance as determined by Harlan Shuyler in his studies on confined populations of Norway rats taken from Indiana sites. These represent only a portion of the 274 food substances tested. The limitations of applying

this information to different circumstances should be very evident.

Norway Rat Food Preferences

Food Base	Preferences
Meats	Frozen horsemeat, beef hamburger, cooked horsemeat, pork shoulder, beef round, beef heart
Vegetables	Frozen sweet com, frozen green peas, canned sweet com, carrots, sweet potatoes, butternut or acorn squash
Fish	Sheepshead, smoked chubs, whitefish, channel catfish, smoked sable, silver salmon
Fruits	Honeydew melon, red delicious apples, dried shredded coconut, cantaloupe, bananas, Thompson seedless grapes
Liquids	Chocolate milk, whole eggs, prune juice, apple juice, lager beer, tap water
Grain and Seed	Breakfast rolled oats, freshly ground whole yellow field corn (only some samples rates this high), steel-cut oat groats, brown/white rice, degerminated yellow corn meal, hominy grits

Cereal grains are preferred for most bait materials as they are readily taken, easily mixed with most rodenticides, and conveniently stored because of their low moisture content. Combining several foods (for example, corn and oats), appeals to a larger number of individual rodents than reliance upon a single food base.

Additives

Additives are added to rodent baits for many different reasons, but some lower the bait's acceptance. Thus, it is necessary to determine if the advantages from their inclusion warrant a resultant lowering of bait intake. These additives include:

Attractants

Attractants are substances that presumably draw rodents to a bait. They are mainly odor producing and rarely add to the palatability of the bait. There is much mythology and little objective information on the effectiveness of attractants. Under objective analysis, many of the old favorites like anise oil have actually

proven to repel more than attract rodents, at least at certain concentrations. Further study of pheromones may eventually provide effective attractants. But attractive odors in commercial baits are probably more of a lure to the buyers than rats.

Binders

Liquids aid in formulating and holding the various bait particles together. Water is most commonly used. However, when it evaporates, the baits harden. Water also hastens molding, so oils are preferred.

Oils can enhance and help distribute the toxicant more evenly throughout the bait. Some binders in rodent baits include bacon grease, peanut oil, coconut oil, cod liver oil, syrup, cottonseed oil, lard, mineral oil, butter, safflower oil, soybean oil, corn oil and glycerin. However, the individual population's reaction to different oils makes it difficult to evaluate them universally. The British claim the best binders for mice are glycerin, corn oil, peanut oil and mineral oil. Studies in this country rated coconut, peanut and corn oils in that order for Norway rats. Animal fats tend to lead to rancidity, with resulting poor bait acceptance, much more quickly than vegetable oils.

Coloring Agents

It is advisable to use color baits as a safety precaution. This should alert human adults to the fact they are not food. Color can also repel birds that, unlike rodents, are color-conscious. However, coloring agents may add a taste factor and reduce acceptance. So select chemicals with care and use at the minimum amounts necessary to serve as a warning.

Enhancers

Compared to attractants, this component increases the palatability of a bait so that more will be consumed. The food base and binders can be considered enhancers. Sugar is the most widely used enhancer that has demonstrated ability to increase palatability. The percentage of sugar most often used in anticoagulant-cereal baits is about 5 percent. Some evidence indicates Dexide (MR-100), a carbohydrate with flavor, increases the acceptance and palatability of anticoagulant baits.

Preservatives

As rodents prefer baits that are not rancid, moldy, insect-ridden or otherwise spoiled,

preservatives may be added to baits. Paraffin-treated baits with the addition of 0.25% parani-trophenol or 0.1% dehydroacetic acid inhibits mold and does not lower bait acceptance to rats. Sodium sulfite (0.1%) has been used to slow spoilage of meat and fish baits in warm weather.

Bait Formulation

When mixing baits, it is essential to follow directions on the label. Too heavy concentrations of toxicant may result in reduction of acceptance by rodents or increased hazards to nontarget animals. On the other hand, too low a concentration may not be sufficient to kill when not enough bait is taken. Thus, you must measure bait components accurately rather than by eye.

It is best to mix the dry ingredients separately. Mix the toxicant with liquid components and the coloring agent, if used, before adding the dry components. Mix thoroughly to get an even dispersion of the toxicant throughout the bait. An incompletely mixed bait is as bad as having incorrect proportions. Part of the batch will be too strong and the rest too weak. If the material is packaged in plastic bags, do some experimentation first. For example, the oil in the bait could leak through the plastic, making the ink run on the label.

If the mixed material is used in the field, provide service technicians with premeasured vials and graduated bait containers to minimize the possibility of incorrect proportions.



Figure 21.
Bait Station.



Figure 22.
Water Bait.

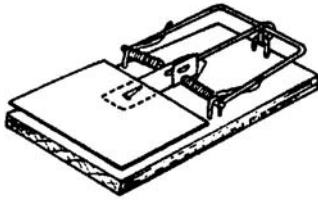


Figure 23.
Enlarged trigger trap.

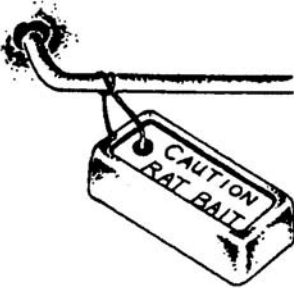


Figure 24.
Paraffin Bait Block.



Figure 25.
Place Packet.

Bait Placement

There are four methods of placing baits in the field.

1. **Wrapped or packaged bait placement** – Small amounts of bait are wrapped in paper or sealed in plastic packets. These reduce hazards to field crews placing the bait. There is more protection for the bait from the weather, thus keeping it fresher. Placements can be made from a distance by throwing packages over an open dump face or in a crawl space under a building. However, rodents sometimes fail to detect the bait materials inside the packet. Others have the tendency to haul them away to hoarding places that may transfer toxicant to the wrong environment.
2. **Bait tray placement** – Wet, dry or liquid baits are exposed in a container. There is no top to the container, and it offers little protection for the bait from the weather or

protection from children or nontarget animals. Ideally, the lip of the container should be no more than 1/2 inch (1.25 mm) high for rats and 1/4 inch (0.6 mm) for mice. But, depending upon circumstances, higher sides will be investigated by the rodents.

The smallest dimension of the base should be at least three times the height to cut down on the possibility of tipping. The tray should be large enough to hold at least 1/2 fluid ounce (15 cc) to 8 fluid ounces (200 cc) of liquid bait or 4 ounces (115 g) to 1 pound (450 g) of solid bait. Any waterproof material except metal is acceptable for liquid containers. Metal may react with the rodenticide solution and create an off-flavor. All trays designed to hold dry baits should be water repellent to prevent moisture seeping in from the bottom, causing the bait to mold.

3. **Covered bait station placement** – Bait stations or boxes are typically utilized for anticoagulant or other multiple-dose baits and in maintenance baiting programs. The bait is placed in covered containers to confine the bait, protect it from the weather and encourage rodents to feed under the protective shelter. They offer a minimal deterrent to children and pets from the baits. Size and shape may vary according to available materials and the amount of bait being placed. Bait stations should be made of waterproof materials to protect the bait from moisture.

While one entry hole is acceptable, two entry holes in line with each other are much more effective, so the rodent can see an escape route as it enters the station. The holes should be between 2 to 3 inches (5 to 8 cm) for rats, but may be as small as 1 inch (2.5 cm) for mice.

There should be a provision for a tray, built-in hopper or other device for securing a water fount. The station should be large enough to contain 4 ounces (115 g) of dry bait or 8 ounces (234 cc) of liquid bait.

4. **Tamper-proof bait station placement** – This is a covered container that not only protects the bait, but also keeps children and pets from it. The following is the EPA definition:

“A tamper-proof bait box is a structure made of material impervious to weather and strong enough to prohibit entry by nontarget species. The access panel must be

securely attached. The entrance must allow easy access for target species, yet prohibit access to bait by larger nontarget species. This can be accomplished by limiting entrance size, by using baffles and/or by incorporating a maze-like construction. The box must be capable of being anchored securely to resist the possible efforts of children, pets, domestic animals or wildlife to move it or displace its contents. It must not constitute an attractive nuisance; e.g., a container which clearly resembles a toy, such as a doll house or sand bucket. Proper precautionary statements must appear in a prominent location. The box must have some internal structure for containing the bait (i.e., a cup holder or raised lip) so that the toxicant will not be exposed on nontarget animals outside the box.”

“Maze-like construction” as suggested above should be a modification of last resort. The obstructions generally decrease rodent acceptance of the station.

For perishable baits, set out bait in the late afternoon so the bait will be fresh when the rodents start feeding around dusk. Baits should be placed where rodents will find them.

Bait stations protect bait from weather, children, nontarget animals and irresponsible persons, as well as offer a place of security in which rodents can feed. Where protection of nontarget animals is not a serious consideration, a board nailed over a runway may be sufficient. Two openings, 2 x 2.5 inches (5 x 6 cm), on each end of the runway should face each other so the rodents can see a ready exit.

When protecting humans and other animals is the prime consideration, the bait station must be (1) completely enclosed, (2) attached so it cannot be moved and (3) have a lockable access panel. Baffles may also prevent small children from reaching inside the small openings.

While rats eat at a number of locations, mice are very erratic feeders. Many small stations are needed to control mice. Place baits or bait stations within 10 feet (3 m) of each other so that mice will intercept a station. Rats have larger home ranges, so baits can be placed 20 feet (6 m) apart. These distances are merely a guide, as a physical layout of a premise will determine optimal patterns of placement.

Baits should be placed under cover, in burrows and along walls. The amount of bait depends on the rodent species, the size of the infestation and the toxicant being used. There

should be more than enough to feed all rodents present. Minimum placements should be 2 ounces (50 g) for mice and 4 ounces (100 g) for rats. Stack the bait so the rodent can see it over the lip of the bait trays. Bait stations should be set out a week before placing bait in them, if possible. Rats will not approach a new object. By waiting a week, the bait will be fresher when the rodents first encounter it.

It is better to replace water solutions completely rather than adding more liquid bait when stations reach a low level. If remaining dry baits are clean and fresh, small amounts can be added at these placements. Stir the bait at each visitation to aerate it and prolong freshness. At first appearance of mustiness or mold, empty and clean the container before refilling.

In baiting a premise, particularly a food-handling or processing establishment, don't overlook the advantages of “perimeter baiting.” There are fewer restrictions on baiting (trapping and gassing, too) outside buildings. It can be easier to remove these peripheral rodents than those firmly established inside a building. Removing these rodents reduces the population of rodents that potentially could inhabit the building at a future time. The job inside will be much easier if the population outside has been reduced or eliminated entirely.

Special Situations – Sewers and Damp Locations

Baits mixed with paraffin are suitable for damp areas such as sewers and marshy outdoor habitats. While paraffin can lower acceptance, this is offset by the protection afforded from water and molds. Ready-made blocks are available commercially, but you can make your own by adding from 33 to 38% paraffin by weight to treated grain.

Heat the paraffin to a liquid state, add the poisoned bait base and mix thoroughly. Pour into a mold to solidify. Put a wire hoop into the mixture before it hardens. Use this handle to tie down the bait and prevent it from being washed away by water or carried away by rodents. An alternative for outdoor placements is to drive a wooden stake through the center of the mix and into the ground.

Waxed paper containers, reusable rubber/silicone molds or similar containers can be used to mold the bait mixture. These can be torn off when the mixture has hardened. Do not use identifiable food containers for molds.

Winter Baiting

Water baits are most effective during warm, dry periods. If water baits are used at temperatures below freezing, alcohol or glycerin up to 25% by weight or volume can be added to the water. These chemicals do lower the acceptance. Another alternative is to increase the sugar content to 10% which will prevent freezing if the temperature remains just below 32°F (0°C). Higher amounts of sugar would reduce bait acceptance.

Bait Testing and Prebaiting

To determine an appropriate bait base, conduct a “bait test” by offering rodents bait food without toxicants. While this can act as “prebaiting,” it is not the same. The purpose of bait testing is to determine the effect of the environment on the food choices of a particular population. Place several different baits in two to ten locations. The baits should be 4 ounces (100 g) amounts and within 1 foot (30 cm) of each other, cafeteria style.

“Prebaiting” involves offering rodents unpoisoned bait for three or more days prior to treatment. This serves to overcome new object shyness and gives an indication of the amounts and optimum locations for placing the toxic materials. This is not necessary when using anticoagulant baits or treating for mice alone. It is a good practice when exposing an acute toxicant for rats in a difficult baiting situation. However, the economic realities of the industry make this impractical under many situations.

Traps and Trapping

There are a number of things wrong with trapping. It doesn't look professional as anybody can buy and set a trap from the dime store. It is very expensive in terms of labor. It is a slow way of removing a heavy infestation.

All true. But trapping has been and should remain a tool for solving rodent problems. Traps can be used where it is necessary to remove an animal completely from the premises eliminating a potential odor problem. Traps can be used where toxicants should not be used such as food handling areas, residences with small children, hog farms and zoos where poisoned rats might be eaten, etc. The snap trap is the best answer for removing pests as humanely as possible without toxicants.

The most important consideration is the attitude of the person doing the trapping. Any

person can set a trap, but the successful trapper realizes he or she is dealing with a wary animal, looks for signs carefully and adjusts methods to outwit the adversary. There are no magic lures to bring rodents into a trap. You have to put traps where the rodents will encounter them.

Types of Traps

Single-Door Cage Trap

Commercially available single-door cage traps such as the Tomahawk® and Kage-All® are durable and function well under field conditions. They are usually the traps to choose when live capture of rats is necessary. These traps will, in many situations, give higher capture success of rats than will snap traps.

Wind-up Multiple Catch Traps

Multiple-catch (automatic) mousetraps such as the Ketch-All® and Victor Tin Cat® are commercially available. A good choice for warehouses, restaurants, food processing plants, etc., these traps work using the principle that mice enter small holes with hesitation. The Ketch-All® has a wind-up spring which powers a rotating paddlewheel that, when triggered, entraps mice in a holding compartment. The Tin Cat® has one-way doors that mice cannot exit, once having entered. Such traps may catch many mice in a single setting, but they should be checked and emptied periodically so that mice do not die of starvation or exposure in the traps.

Snap Traps

The “snap trap” is cheap, easy to operate, requires few inspections, can be set in many situations, and since the animal is killed almost instantly, more humane.

Operation of Traps

One basic principle of effective trapping is that time and opportunity are lost if the trap set in the field is not in prime operating condition. In using cage traps, the triggers should be checked several times to achieve the proper sensitivity to respond to the weight of the target animal. Double entrance traps with mesh sides present the least sinister appearance to the proposed victim. They should be as large as possible and still enable the target animal to trip the trigger. The simpler the trigger mechanism of these traps, the less chance of failure.

The trigger mechanism for snap traps must also be in good working condition. Be certain the

staples holding the spring are firmly embedded in the wood. The trigger catch should be bent in the right position so that the bait pan lies at the proper distance above the trap base. The wooden base should be flat and not warped or it will roll as the rodent steps on it. While some commercial firms make enlarged bait pans for their traps, these can be added easily to others. Material can be of corrugated cardboard, fly screening, wire mesh, sheet metal, etc. A really good material for mousetraps is made from aluminum cans. This material is easy to work, light in weight, does not rust and will not become limp as cardboard does in damp situations. In making the pan, cut it out at least 1/4 inch (0.5 cm) smaller than the area covered by the trap jaw. Rivet or fasten to the regular bait pan. The leverage increases the sensitivity of the trigger, and for runway traps, provides additional surface area to increase the possibility of the rodent tripping it as it runs down a trail.

When oiling a trap, use a medicinal grade mineral oil instead of a petroleum-based oil as this may increase repellency. Traps do not have to be clean to be effective; in fact a dirty trap is probably less repellent to a mouse than a shiny new one from the factory. But while dirt is probably attractive to mice, in a commercial situation, its value must be weighed against its public relations effect.

Traps should be cleaned up and possibly painted before placing at a food-handling account. Painting with a water-based fluorescent paint may aid in recovery of the few traps that might be dragged away. Numbers should be painted on them to help in record keeping. This also adds to the professional appearance of these devices.

A hole should be drilled in one corner as close to the edge as possible on the side away from the bait pan. It is rarely necessary to set a drag or otherwise fasten down these traps on a horizontal surface. But if the occasion arises, a drag wire can be slipped through this hole without interfering with the operation of the jaw when it is pulled back in the set position. This hole also makes a convenient way to string a number of traps on a wire for ease of transporting.

Store traps away from insecticides or other chemicals that might impart a strong repellent odor. Carry them on wires or in boxes where they'll be kept in order rather than carelessly tumbled into a heap with resultant damage to trigger mechanisms.

Trap Placement

Next to having a trap that will function properly, the most important consideration is proper trap placement. Do not rely on any lure to bring the animal to the trap. Put the trap in a place where the rodent will literally stumble over it in the normal course of his activities. Put traps next to walls, in dark corners, behind and under objects, where tracks and droppings are numerous, and in normal travel lanes going from cover to food and water. Force the animals to pass over the trigger by putting boxes or boards to form barriers that will guide them to where you want them to cross.

Placement of Snap Traps

Traps should be placed in groups or areas so they can be easily accounted for. Use many rather than a few traps. Possibly a dozen would be the minimum number to use in a private dwelling while 50 to 100 is not excessive for a warehouse or other commercial installation. Traps should not be spaced more than 10 feet (3 m) apart, preferably as close as 3 feet (1 m) for mice due to their limited range in certain environments. For rats a minimum of 20 feet (6 m) should be observed.

Trap shelters are an effective modification of trapping technique. They enhance the professional appearance of the job. It is easier to locate the traps when rechecking. The possibility of something being dropped on the traps and setting them off is reduced. The trap is anchored so an animal cannot drag it off. Trapped animals are concealed from a sensitive human audience. They provide the necessary guide forcing the animal to pass over the triggers of runway traps. The danger to pets and children is somewhat reduced. In building the shelter, make certain it is curved enough to give clearance to the jaw as it closes.

If rodents are difficult to trap, it is possible to bury traps lightly in sawdust, flour, feathers, confetti, etc. Bait is set in the center and the traps left unset for several days to overcome shyness. When covering with loose material, it is necessary to put a lightly rolled wad of cotton under the bait pan or lay a small piece of paper or cloth over the bait pan to keep the material from sifting under the pan and preventing it from moving. In other situations it might be necessary to set traps in groups of three or more where animals appear to be jumping over a trap set. Tracking patches can be used to locate good trapping areas and activity around an ignored

trap. Do not place traps above food handling areas. It is better to trap a small area intensively than undertrap a larger one as this increases the danger of educating a population into trap shyness.

Baiting Traps

A chapter could be written solely about baiting and not cover all the circumstances. Different baits for different places seem to be the story. Some good basic baits for mice are peanut butter, cereal, raisins, nutmeats, bread, bacon, gumdrops, strawberry jam, etc, and for Norway rats about the same plus meat, fish and pieces of wieners. For roof rats fresh fruit and nutmeats seem to be about the best. The best procedure is to use three or more different baits in a given area and keep a record of those that appear more attractive.

If fresh baits like meat or fish are used, replace them often to maintain attractiveness. Baits should be secured to the bait pan by thread or wire to prevent it from being stolen. It is recommended that traps be baited and left unset for three or more days to accustom the animals to this new source of food; however, this is often economically impractical. With reality in mind, this practice should be used only for the few occasions you encounter a rat population demonstrating a high degree of trap shyness and "new object" reaction.

Runway traps do not normally need to be baited. However, capture can be improved using bait. Peanut butter smeared in the center of the bait pan or cereal sprinkled over the surface are good attractants.

It is good practice to bait with attractive foods not present in the area when there is considerable competition from available food sources. It is not always necessary to use food materials. Cotton can be tied to the trigger in places where nesting material is apparently at a premium.

The use of odors as attractants to increase trapping success is not clearly understood. Do not pet a dog or cat before handling traps. Rodents may avoid these odors but they are not bothered by human scents. Probably odors of other rodents will attract. Some pest managers feel putting traps in cages of rats or mice before exposing them in the field will help condition them. Others swear by various chemical odors such as cinnamic aldehyde produced by rubbing a split red carnation over the bait pan. An increased understanding of pheromones may some day assist in this area, too.

Trapping Schedules

In planning a trapping program, it is best to set a large number of traps at first and then taper off. Traps should be checked each morning to remove dead rodents from view. If possible, the trap line should be rechecked in the late afternoon. Clients do not want to see the visual evidence of a successful catch.

As mentioned before, it is better to trap small areas intensively than larger ones extensively. It is also better trap intensively for 2 to 3 weeks and then suspend trapping completely. If they can be spared, traps should be unsprung and left in place. After a couple of weeks trapping can be started up again. One problem with trapping is young rodents being weaned seldom get out of the nest far enough to reach your traps. This blank period will give you a better chance of getting these animals as they grow large enough to find your traps.

Another argument for keeping close records on the catch is that you will be able to pick out unproductive locations. Traps should not be moved about constantly as it may take a while for animals to approach them. Those that are unproductive after seven days should be moved to more fertile hunting grounds.

In taking animals out of the traps, do not handle them any more than necessary. You can usually drop them in a paper or plastic sack without having to touch them. If you have to pick them up, use gloves or tongs. An insecticide should be sprayed or dusted around the trap area and over the trapped animals. A dust like carbaryl is good for this purpose. This practice is essential in areas where vector borne diseases are prevalent.

Rodent Glues

Rodent glues are sticky chemicals that entangle the victim like flypaper. Ready-to-use glue boards are commercially available from various suppliers, or bulk glue can be purchased. The sticky material is spread on heavy craft paper, cardboard, roofing paper, boards, etc. Lengths of it are placed in runways. When an animal steps on the glue he is unable to remove his foot. His struggles will eventually cause him to end up with more feet and possibly his nose in the material. Glue boards are used under most of the same situations as traps and are sometimes effective where trap shyness has developed. Glues are nontoxic and hold the animals for disposal the same as traps.

Problems with glue boards can occur in extremely hot weather when some glues can run off the board and cause staining. On the other extreme, in cold weather the material may harden too much to be effective. In dusty areas, the surface may coat over so that it is unable to hold the animal.

Before handling bulk glue, wet your hands and putty knife with soap and water. Scoop up the glue and spread it on a sheet of roofing paper or other backing material. It is best to keep these separate. However, where necessary, another piece can be squeezed on top of this to form a sandwich. Pry the pieces apart when ready to use making sure the glue does not run out to the edge of the backing material.

Glue boards are more effective for capturing mice than rats. In severe mouse infestations,

they can be used to quickly and safely reduce mice populations. Unless placed under cover, glue boards should not be used in areas where there is excessive dust.

Predators

Dogs and cats, particularly certain individual animals, will catch and kill rodents. However, there are few situations where they do so sufficiently to control rodent populations. Around most structures, rats and mice can find many places to hide and rear their young out of the reach of such predators. It is not uncommon to find rats or mice living in close association with cats or dogs, relying on pet food for nourishment. Rats often live beneath a doghouse and soon learn they can feed on the dog's food when he is asleep or absent.