



Controlling House Mice

Ways to recognize mouse problems and control mice.

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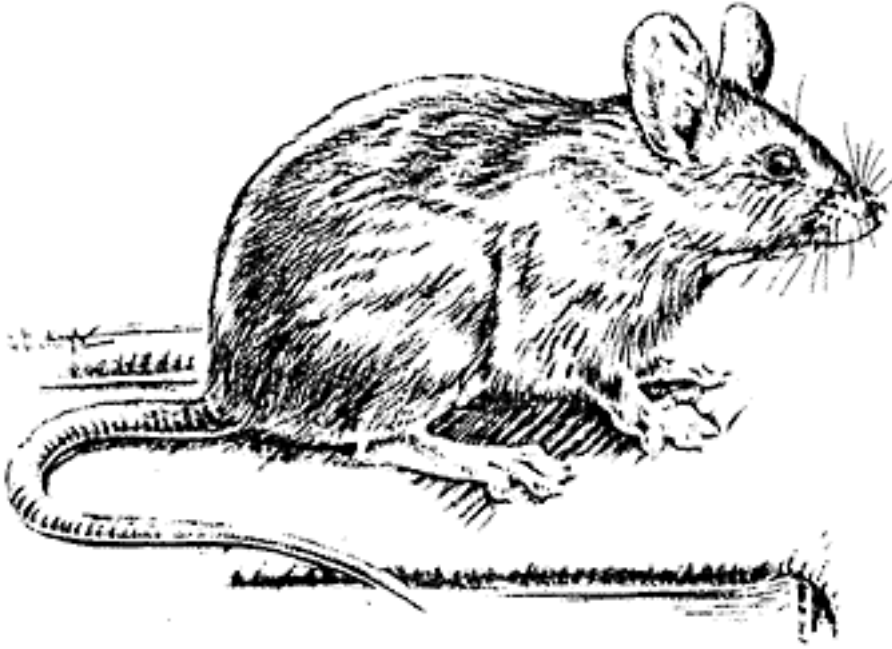
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The house mouse (*Mus musculus*) is considered one of the most troublesome and economically important rodents in the United States. House mice thrive under a variety of conditions. They are found in and around homes and farms as well as in open fields and agricultural lands. House mice consume and contaminate food meant for humans, livestock, or other animals. They cause damage to structures and property, and they transmit diseases such as salmonellosis and swine dysentery.

Recognizing Mouse Infestations

Droppings, fresh gnaw marks and tracks indicate areas where mice are active. Mouse nests, made from fine shredded paper or other fibrous material, often are found in sheltered locations. House mice have a characteristic musky odor that identifies their presence. Mice are active mostly at night, but can be seen occasionally during daylight hours.

House Mouse Facts



House mouse, *mus musculus*

House mice are small rodents with relatively large ears and small black eyes. They weigh about 1/2 ounce and usually are light gray in color. An adult is about 5 1/2 to 7 1/2 inches long, including the 3- to 4-inch tail.

Although house mice usually feed on cereal grains, they will eat almost anything. They are sporadic feeders, nibbling bits of food here and there.

Mice have keen senses of hearing, smell,

taste and touch. They are excellent climbers and can run up any rough vertical surface. They will run horizontally along wire cables or ropes and can jump up 12 inches from the floor onto a flat surface. Mice can squeeze through openings slightly larger than 1/4 inch in diameter.

In a single year, a female may have five to 10 litters of usually five or six young each. Young are born 19 to 21 days after mating, and they reach reproductive maturity in six to 10 weeks. The life span of a mouse is usually nine to 12 months.

House Mouse Control

Effective control involves three aspects: sanitation, mouse-proof construction, and population reduction. The first two are preventive measures. When a mouse infestation already exists, some form of population reduction almost always is necessary. Reduction techniques include trapping, poisoning, and fumigation. A flow chart outlining steps in house mouse control is found in *Figure 1*.

[Figure 1. Flow chart of steps in house mouse control.](#) Additional factors, such as the cost of particular control methods, must be considered when planning a control program.

Sanitation. Proper sanitation is an important step in controlling house mouse populations. In particular, eliminate places where mice can find shelter. They cannot survive in large numbers if they have few places to rest, hide, or build nests and raise their young. Total elimination of mice through sanitation, however, is almost impossible. Mice can survive in small areas with limited amounts of food and shelter. Most buildings where food is handled or stored will have problems with house mice, no matter how clean they are if they have not been "mouse-proofed."

Rodent-proof construction. Mouse-proof construction is the most successful and permanent form of house mouse control. "Build them out" by eliminating all openings larger than 1/4 inch through which they can enter a structure. Steel wool makes a good temporary plug. Seal cracks in building foundations and openings for water pipes, vents, and utilities with metal or concrete. Doors, windows and screens should fit tightly. Cover the edges of doors and windows with metal to prevent gnawing. Latex, plastic, rubber, wood, or other gnawable materials are unsuitable for plugging holes used by mice. Refer to NebGuide [G94-1217, Rodent-Proof Construction: Drains and Feeding Equipment](#) for more information.

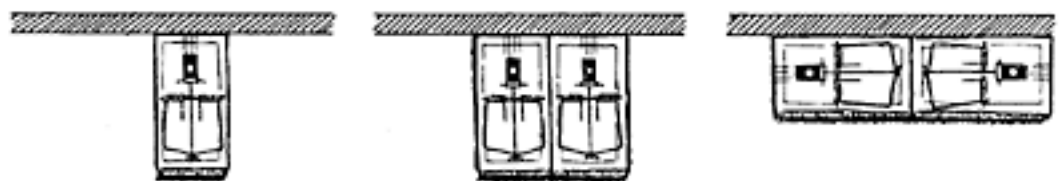
Traps. Trapping is an effective control method for controlling house mice. Although time-consuming, it is the preferred method in homes, garages and other structures, where only a few mice are present. Trapping has several advantages: 1) it does not rely on inherently hazardous rodenticides; 2) it permits the user to view his or her success; and 3) it allows for disposal of trapped mice, thereby eliminating dead mouse odors that may occur when poisoning is done within buildings.

Simple, inexpensive wood-based snap traps are effective and can be purchased in most hardware and grocery stores. Traps can be baited with a variety of foods; peanut butter is the most popular because it is easy to use and very attractive to mice. Set the triggers lightly so the traps will spring easily. Leave traps unset until the bait has been taken at least once to reduce the chance of mice becoming trap-shy.

Multiple-capture live traps for mice, such as the Victor Tin Cat® and the Ketch-All®, also are available in many hardware and feed stores. They can catch several mice at a time without being reset, and therefore reduce labor requirements.

Set traps behind objects, in dark corners, and in places where evidence of mouse activity is seen. Place them close to walls so mice will pass directly over the trigger (*Figure 2*). Traps can be set on ledges, on top of pallets of stored materials, or any other locations where mice are active.

Figure 2. Placement of snap traps. a) Single trap with trigger next to wall. b) The double set increases your success. c) Double set placed parallel to the wall with triggers to the outside.



Use enough traps to make the effort short and decisive. Mice seldom venture far from their shelter and food supply, so space traps no more than about 10 feet apart in areas where mice are active.

An alternative to traps are glue boards, which catch and hold mice that are attempting to cross them, in much the same way flypaper catches flies. Place glue boards along walls where mice travel. Do not use them where children, livestock, pets or desirable wildlife can contact them. Glue boards lose their effectiveness in dusty areas unless covered. Extreme temperature also may affect the tackiness of glue

boards.

Rodenticides. Single-dose and multiple-dose rodenticides (toxic baits) and fumigants are registered for house mouse control. A wide variety of active ingredients and formulations are available. We recommend you use commercially prepared materials, because they do not require that applicators handle concentrated materials that are more hazardous.

Single-dose rodenticides. Single-dose rodenticides are more hazardous than the multiple-dose (anticoagulant) rodenticides. Therefore, single dose toxicants should be used by professional pest control operators or other persons familiar with their use. Single-dose rodenticides (*Table I*) will give a quick knockdown of a mouse population. They may be preferred where mice are abundant or where it is difficult to get mice to accept a bait for several days in succession because of competing food items.

Bait acceptance can be increased by "prebaiting" with unpoisoned bait for several days before the rodenticide is offered. If acceptance of prebait is poor, do not apply toxic bait, but change bait material or its placement. "Bait shyness" can occur with some single-dose rodenticides such as zinc phosphide, so it is best to use them only once per year at any location.

Remove and destroy all uneaten bait at the end of a poisoning program. Never leave single-dose baits exposed for more than three to four days.

Table I. Single-dose rodenticides and the percent of active ingredient commonly used for house mouse control.

Common name	Chemical name	Percent active ingredient used in food bait
Bromethalin (Assault®, Trounce®)	N-methyl-2,4-dinitro-N-(2,4,6-tribromophenyl)-6-trifluoromethyl)benzenamine	0.005 - 0.01
Cholecalciferol, Vitamin D ₃ (Quintox®, Rampage®)	9,10-Seocholesta-5,7,10(19)-trein-3-betaol	0.075
Zinc phosphide (ZP®)	zinc phosphide	1.0 - 2.0

Multiple-dose (anticoagulant) rodenticides. Multiple-dose rodenticides (*Table II*) generally are considered much safer than single-dose rodenticides. Anticoagulants cause death as a result of internal bleeding, which occurs as the animal's blood loses the ability to clot and capillaries are damaged. The

active ingredients are used at very low levels, so bait shyness does not occur when using properly formulated baits.

Mice must feed on most anticoagulant baits for several days before death will occur. Fresh bait must be made available to mice continuously for at least two weeks, or as long as feeding occurs. There are exceptions, however, such as brodifacoum and bromadiolone, that are capable of causing death after a single feeding, but the mice do not die for several days. Vitamin K is an antidote for several anticoagulant rodenticides.

Table II. Multiple-dose (anticoagulant) rodenticides and the percent active ingredient usually found in food baits for house mouse control.

Common name	Chemical name	Percent active ingredient used in food bait
Brodifacoum (Havoc®, Talon-G®)	3-{3-[4'-bromo(1,1'-biphenyl)-4-yl]-1,2,3,4-tetrahydro-1-naphthalenyl}-4-hydroxy-2H-1-benzopyran-2-one	0.005
Bromadiolone (Maki®, Contrac®)	3-{3-[4'-bromo(1,1'-biphenyl)-4-yl]-3-hydroxy-1-phenylpropyl}-4-hydroxy-2H-1-benzopyran-2-one	0.005
Chlorophacinone (RoZol®, AC 90)	2-{(p-chlorophenyl)phenylacetyl}-1,3-indandione	0.005
Diphacinone (Ramik®, Bait Blocks®)	2-diphenylacetyl-1,3-indandione	0.005
Pivalyl, Pindone (Pival®, Pivalyn®)	2-pivalyl-1,3-indandione	0.025
Warfarin (d-Con®)	3-(a-acetonylbenzyl)-4-hydroxycoumarin	0.025
Warfarin + sulfaquinoxaline (Proline®)	3-(a-acetonylbenzyl)-4-hydroxycoumarin + quinoxaliny sulfanilamide	0.025

Bait selection and placement. Several types of anticoagulant baits are available . Grain baits or pelleted forms often are purchased in bulk or packaged in small plastic, cellophane, or paper packets. These

"place packs" keep baits fresh and make it easy to place baits into burrows, walls, or other locations. Mice will readily gnaw into place packs and feed on baits.

Anticoagulant baits formed into paraffin blocks are useful in damp locations, such as sewers or gutters, where loose grain baits spoil quickly. Unfortunately they are not accepted by mice as readily as other baits. A particularly good bait for house mice is whole canary grass (*Phalaris canariensis*) seed.

Anticoagulant baits also are available as sodium salts mixed into a water solution. Although mice require little free water to survive, water baits can be effective where moisture is scarce and mice are feeding on dry grain or livestock feed. Consider using water baits as a supplement to other control measures.

Proper placement of baits is important for house mouse control. Place baits no more than 10 feet apart in areas where mouse activity is evident. If mice are living in wall spaces, place baits inside the walls.

We highly recommend the use of bait stations when applying any toxic bait. They protect rodenticides from weather and provide a safeguard to people, pets and other animals. Bait stations should have at least two openings about one inch in diameter and should be large enough to accommodate several mice at one time. Place bait boxes next to walls (with the openings close to the wall) or in other places where mice are active. Clearly label all bait boxes "Caution -- Mouse Bait" as a safety precaution.

Establish bait stations in and around the perimeters of buildings where it is impossible to exclude rodents. Place fresh anticoagulant bait in these stations to control invading mice before breeding populations become established. For more information, refer to NebGuide [G94-1215, Bait Stations for Controlling Rats and Mice](#).

Fumigants. Fumigants (poisonous gases) occasionally are used to treat structures, railway cars, or other enclosed areas. Aluminum phosphide is the most commonly used fumigant registered for house mouse control. Fumigation with other products for insect control often leads to the incidental kill of house mice. Where practical, fumigation is a quick way to achieve 100 percent rodent control. If a building has to be completely tarped to contain the fumigant, however, the operation is expensive.

Caution: fumigants are highly toxic to humans and other animals, and must not be used where occupants of a building could be exposed to the gases. Only licensed structural pest control operators should use fumigants in any buildings or enclosed structures.

Safety precautions. Carefully follow all product label recommendations. In addition, certain general safety precautions should be followed. Consider all rodenticides dangerous enough to cause death, and place baits where only rodents can access them. All rodenticides present some degree of hazard to humans, livestock, pets, and other non-target animals.

Use prepared or ready-to-use baits to reduce the risks involved in handling concentrated toxicants. Label all bait containers and bait stations clearly with appropriate warnings. Store unused bait, concentrates,

and fumigants in a locked cabinet out of the reach of children or animals.

Pick up all accessible dead mice after a poisoning program. Use rubber gloves or tongs and dispose of them by burial or incineration. If only a few mice are present, place them in a plastic bag, close it tightly, and dispose of it with your household garbage.

Electronic devices. Although mice are easily frightened by strange or unfamiliar noises, they quickly become accustomed to regularly repeated sounds. Ultrasonic sounds, those above the range of human hearing, have very limited use in rodent control because they are directional and do not penetrate behind objects. They also lose their intensity quickly with distance. There is little evidence that electronic, sound, magnetic, or vibrational devices of any kind will drive established mice or rats from buildings or provide adequate control.

Predators. Although cats, dogs, and other predators may kill mice, they do not provide effective mouse control in most circumstances. Mice often live in very close association with dogs and cats. Mouse problems around homes often are related to the food, water and shelter provided for the pet.

If rat control is also a problem, see [NebGuide G92-1106, Controlling Rats](#).

To simplify information, trade names of some products have been used in the text and tables. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

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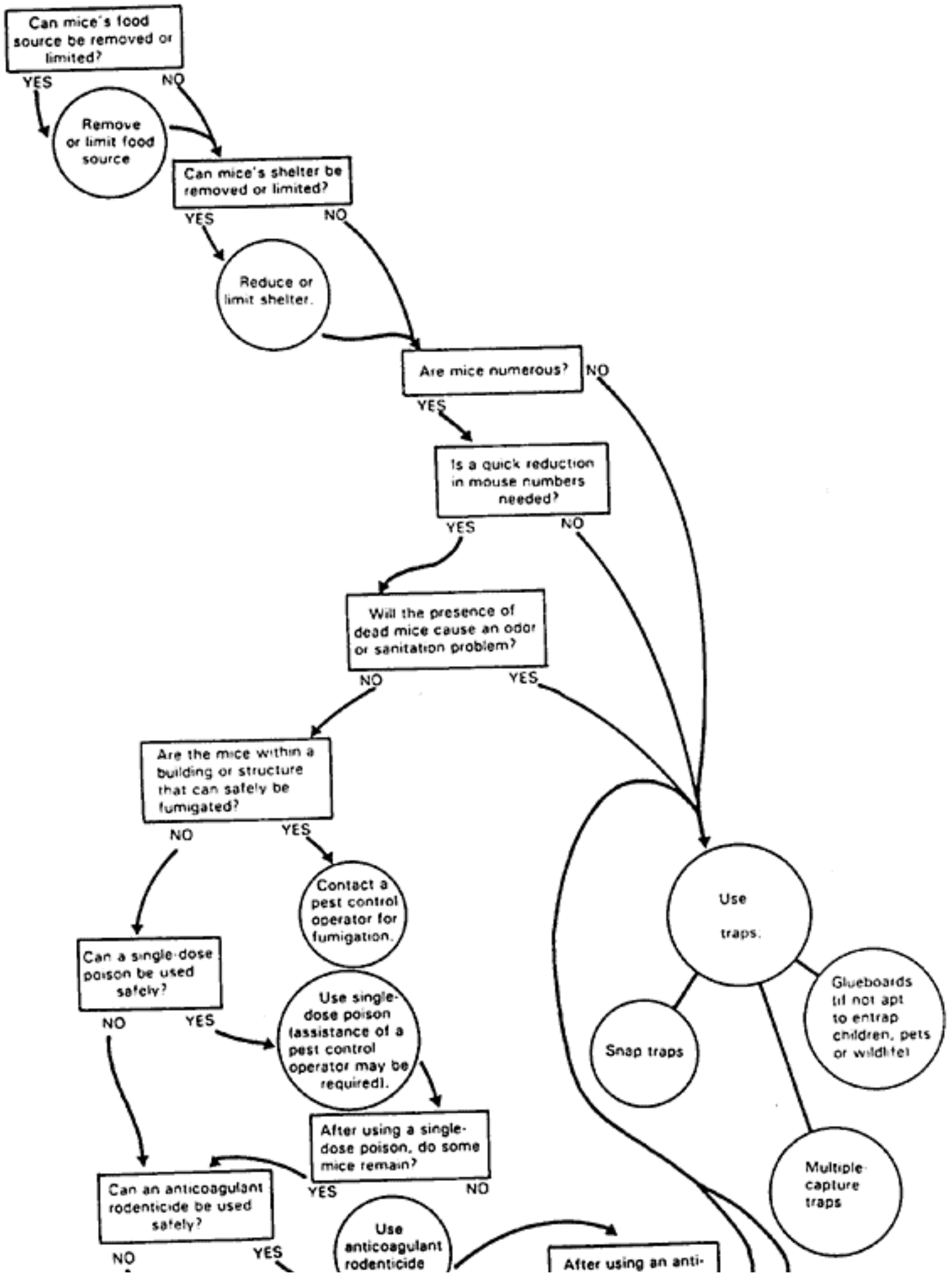
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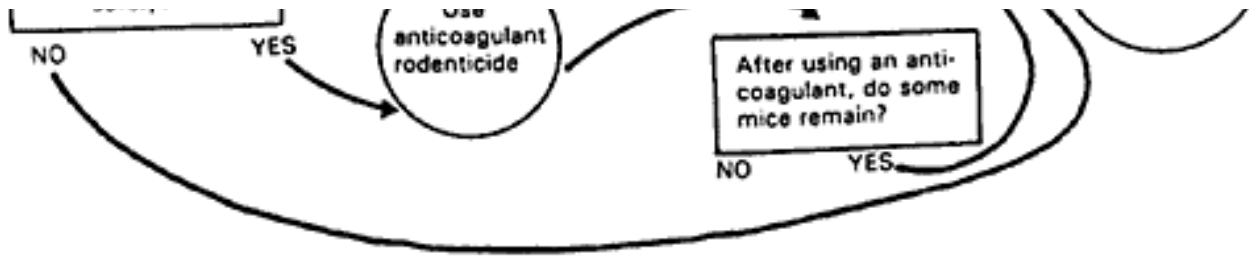
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Nebraska Cooperative Extension G94-1217-A (Revised November 2003)



Rodent-Proof Construction: *Drains and Feeding Equipment*

Techniques are described in this NebGuide for excluding rodents from drains, pipes, feed bunks, bins, and storage containers.

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- [Mechanical Guards](#)
- [Livestock Feed Bunks and Bins](#)
- [Feed and Refuse Storage](#)

Rodents often travel along pipes, electrical cables, conduits, drains, and other equipment to gain access to buildings used for housing livestock and storing feed. Rodent-proof materials should be installed to prevent access to buildings along these routes. Additional methods to consider in an integrated pest management (IPM) program include sanitation, toxicants, and trapping. For additional information on rodent control, see NebGuides 92-1105, Controlling House Mice; 92-1106, Controlling Rats; and 03-1530, Rodent-Proof Construction: Structural at the University of Nebraska Cooperative Extension Publications Web site (<http://www.ianr.unl.edu/pubs/wildlife>) or the Web site on rodent control in swine operations

<http://rodent.swine.unl.edu>.

Drains and Pipes

Both rats and mice use drainage pipes or sewage systems as routes to enter buildings. Equip floor drains with metal grates that securely fasten in place. Use grates with openings that are 1/4 inch or less.

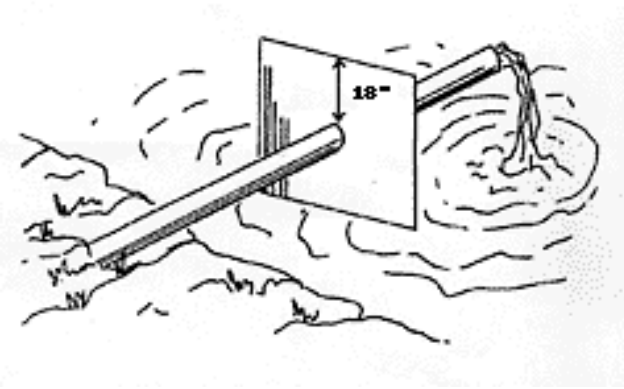


Figure 1. Shield manure discharge pipes to prevent access by rodents.

Systems for managing manure in livestock facilities often include periodic draining of manure and water from the building to a lagoon or other storage area. Extend discharge pipes far enough over the bank or into the lagoon to prevent rodents from jumping or crawling into the open end. Install rodent shields (*Figure 1*), or use a downward-turned elbow to prevent rodents from gaining access. A hanging metal cover at the open end of the discharge pipe, with a hinge at its upper edge, can also be effective. The hinge must operate easily so water or manure will open the cover and the cover must fall back into the closed position when the flow stops. Hanging covers sometimes freeze shut, so they must be

checked regularly.

Always cap pump-out ports for manure storage pits when the ports are not in use. Open ports allow easy entry to rodents.

Mechanical Guards

Install guards made of sheet metal or similar materials to prevent rodents from climbing or traveling along particular routes. Guards must be wide enough and positioned to keep rodents from climbing over or jumping around them. Attach sheet metal bands to walls to prevent rodents from climbing. Rodent guards on walls should be 12 to 18 inches wide and 36 inches above the floor or ground level.

Install guards to prevent rodents from climbing the outside of buildings that have rough exterior walls. Use rodent guards in combination with hardware cloth, or other suitable materials to make corncribs, bins, and other buildings rodent-proof (*Figure 2*).

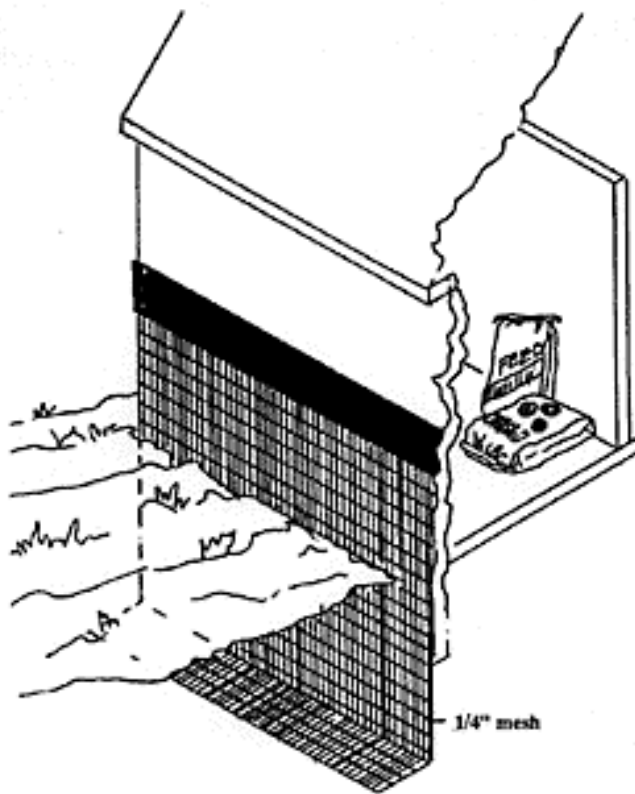


Figure 2. Feed sheds, corn cribs and other existing wood structures can be rodent-proofed by installing hardware cloth topped by a band of sheet metal. The hardware cloth can also serve as a curtain wall to prevent rodent burrowing.

discourage rats from burrowing under aprons, you may need to build a foundation to prevent burrowing around the sides of the aprons that do not receive use by cattle.

Concrete foundations for feed bins should extend 36 inches below grade at the outer edges to prevent rats from burrowing under the slabs (*Figure 5*). Install 3 inches of 1 1/2-inch crushed rock and maintain a clean, weed-free zone around the perimeters of slabs to discourage burrowing by rats and to permit easier detection of rodent activity.

Install flat guards to prevent rodents from traveling along walls where horizontal or vertical pipes, wires, conduit, and cables are attached (*Figure 3*). Install cones or discs on cables, ropes, augers, or pipes (*Figure 4*). Guards that hang freely are easily damaged. Construct circular guards of 24-gauge sheet metal and anchor them in place by one or more arms on the side opposite to that which is accessible to rodents. Circular guards must extend out 18 inches around the lines they guard. Cone-shaped circular guards prevent rats from climbing vertical pipes, pilings, and trees. Use shields or wire guards made of 1/4-inch wire mesh to exclude rodents from the interior of feed augers, fan housings, and similar openings. With some ingenuity, you can design rodent guards to fit any situation.

Livestock Feed Bunks and Bins

Rats often burrow and establish dens under feed bunks that are placed directly on the ground, on concrete blocks, or near ground level. Set concrete bunks solidly on concrete aprons to eliminate rodent habitat (*Figure 5*). Though traffic by cattle may

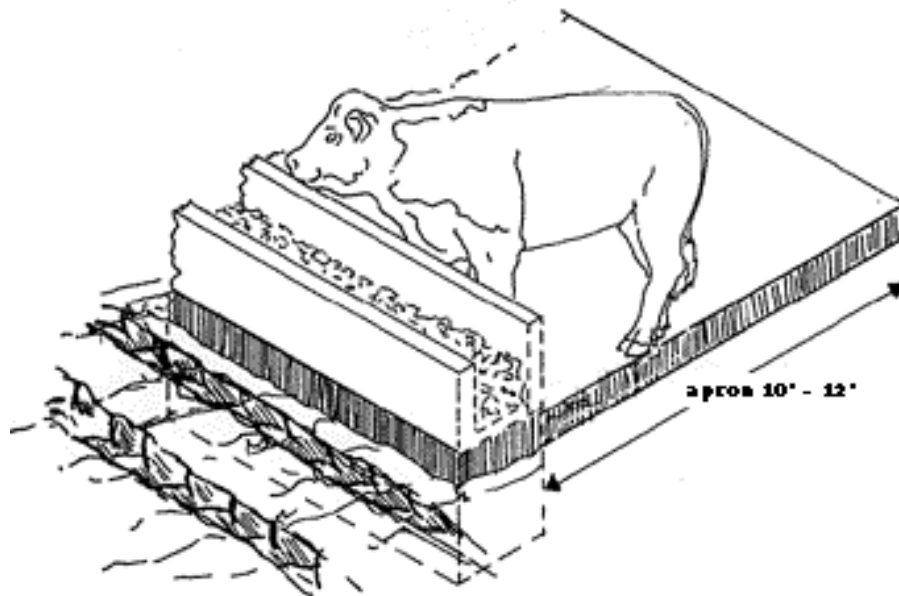


Figure 5. Rats cannot live under or around feed bunks that do not provide shelter.

Feed and Refuse Storage

Proper storage and disposal of waste and dead animals is a very important part of rodent control. Good sanitation limits rodents' sources of food, water, and shelter. Always store livestock or pet feed in metal cans with tight-fitting lids or similar rodent-proof containers (*Figure 6*). Racks prevent them from being tipped over by dogs or other animals..

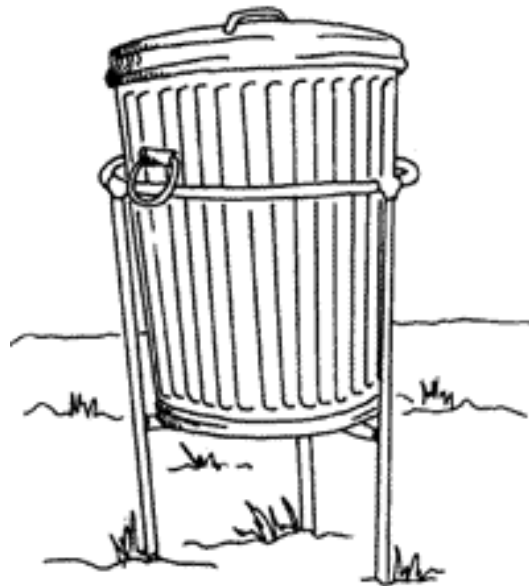


Figure 6. Use metal containers with tight-fitting lids to store waste.



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G94-1215-A



Bait Stations for Controlling Rats and Mice

This NebGuide describes the design and safe use of bait stations for rat and mouse control. It includes information on correct bait station placement and bait selection.

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Toxic baits are often used to control the damage caused by Norway rats (*Rattus norvegicus*) and house mice (*Mus musculus*). Bait stations used in rodent control programs may increase both the effectiveness and safety of rodent baits (rodenticides).

Bait stations are useful because they:

- protect bait from moisture and dust;
- provide a protected place for rodents to feed, allowing them to feel more secure;

- keep other animals (pets, livestock, desirable wildlife, etc.) and children away from toxic baits;
- allow you to place bait in some locations where it would otherwise be difficult because of weather or potential hazards to non-target animals;
- help prevent the accidental spilling of bait;
- let you inspect bait easily to see if rodents are feeding on it.

Kinds of Bait Stations

Bait stations can be designed for either rats or mice. They can contain solid and/or liquid baits.

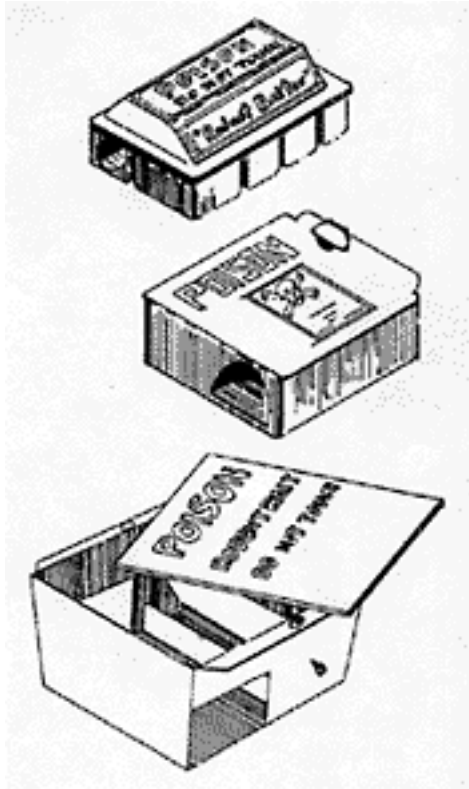


Figure 1. Examples of commercial rodent bait stations.

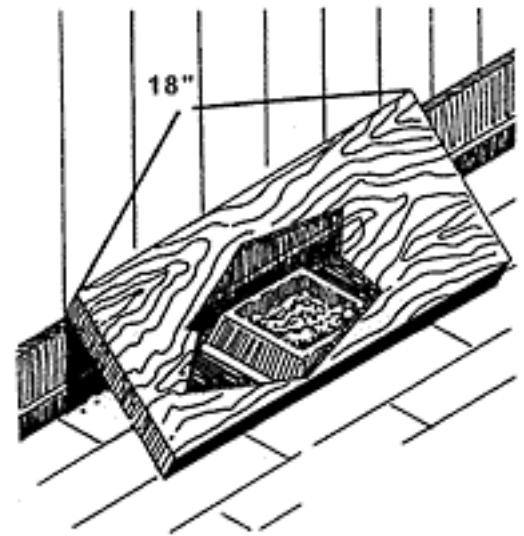
You can purchase bait stations from commercial suppliers or make them yourself. Manufactured bait stations made of plastic, cardboard or metal are sold to pest control companies and to the public (*Figure 1*). They come in various shapes and sizes for rats or mice. Some farm supply and agricultural chemical supply stores have them in stock or can order them.

Bait stations can be built from scrap materials, and you can design homemade stations to fit your particular needs. Make them out of sturdy materials so they can't be easily knocked out of place or damaged. Where children, pets or livestock are present, construct the stations so that the bait is accessible only to rodents. Locks, seals or concealed latches are often used to make bait stations more tamperproof. Clearly label all bait stations with "POISON" or "RODENT BAIT -- DO NOT TOUCH," or with a similar warning.

Bait Station Design

Bait stations should be large enough to allow several rodents to feed at once. They can be as simple as a flat board nailed at an angle between the floor and wall (*Figure 2*), or a length of pipe into which bait can be placed (*Figure 3*). More elaborate stations are completely enclosed and can contain liquid as well as solid rodent baits (*Figure 4*). Hinged lids provide convenient inspection of permanent stations.

Figure 2. A flat board nailed at an angle between the wall and floor protects rodent bait from non-target animals and allows rodents to feed in a sheltered location. The board should be at least 18 inches long to keep pets and children from reaching the bait.



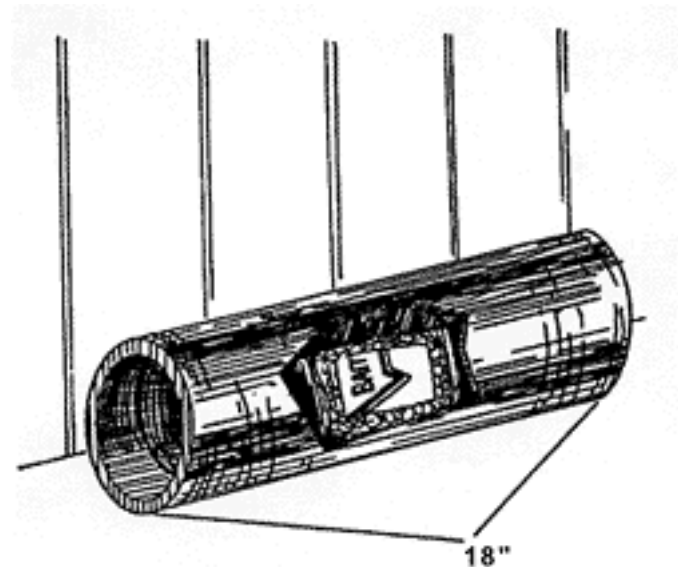
Bait stations for rats should have at least two openings about 2 1/2 inches in diameter. Cut the holes on opposite sides of the station so rats can see an alternate escape route as they enter the station.

Bait stations for mice should have entrances 1 to 1 1/2 inches in diameter. Stations for mice can be considerably smaller than those for rats. A cigar box about 10 x 6 x 2 inches high, with a hole in each end is ideal for mice.

Bait Selection

Bait stations work best when you use commonly available commercial rodent baits. Most of these baits are multiple-dose (anticoagulant) rodenticides. For these baits to be effective, rodents must feed on them over a period of days. Label instructions on such baits typically state, "Provide an uninterrupted supply of bait for at least 15 days or until all signs of feeding have stopped."

Figure 3. Rodent bait station made from a length of pipe. Pipe diameter can be 2 to 3 inches for mice; 3 1/2 to 6 inches for rats.



Multiple-dose baits are available in several forms -- loose grain, pelleted grain mixtures, paraffin-grain blocks, extruded blocks and water-soluble concentrates. Loose grain and pelleted baits are often sold packaged in small paper, cellophane or plastic packets. These "place packs" can be placed into the bait station intact, or can be opened and emptied into the box. Place packs are also useful for placing bait into wall spaces, rodent burrows and other restricted locations. Rats and mice gnaw into the packet to eat the bait. A multiple-dose bait made from canary grass seed is especially attractive to house mice and therefore gives good control in many situations.

Liquid baits also work well in places where rodents have few water sources, such as granaries. Simply mix the dry concentrate with a measured amount of water. Liquid baits that contain a small amount of sugar are particularly attractive to rodents. Rats will often come to water stations because they need water daily unless they are feeding on very moist food. Although mice can survive without drinking

water, they will use it when it is available. Because many kinds of animals drink water, protect receptacles containing liquid rodenticides from use by non-target animals. Enclose liquid bait containers within bait stations to reduce hazards to pets, livestock and wildlife.

See NebGuides [G92-1105-A, Controlling House Mice](#) and [G92-1106-A, Controlling Rats](#) for additional information on bait types and selection.

Bait Station Maintenance

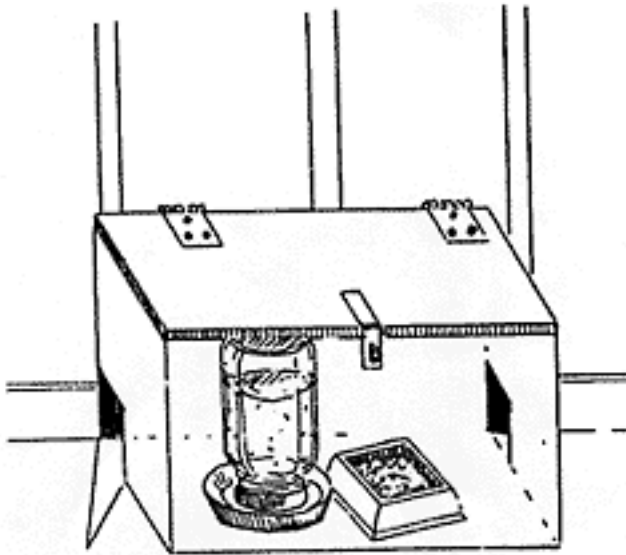


Figure 4. A home-made bait station can contain liquid as well as solid (cereal) baits.

When using multiple-dose (anticoagulant) baits, it is very important that they be fresh and of high quality. Rats and mice often reject spoiled or stale foods. Provide enough fresh bait for rodents to eat all they want. When you first put bait stations out, check them daily and add fresh bait as needed. After a short time, rodent numbers and feeding will decline, and you will need to check the stations only every two weeks. If the bait becomes moldy, musty, soiled or insect-infested, empty the box and clean it, and then refill it with fresh bait. Dispose of spoiled or uneaten bait in accordance with the label. Follow all label

directions for the product you are using.

Bait Station Placement

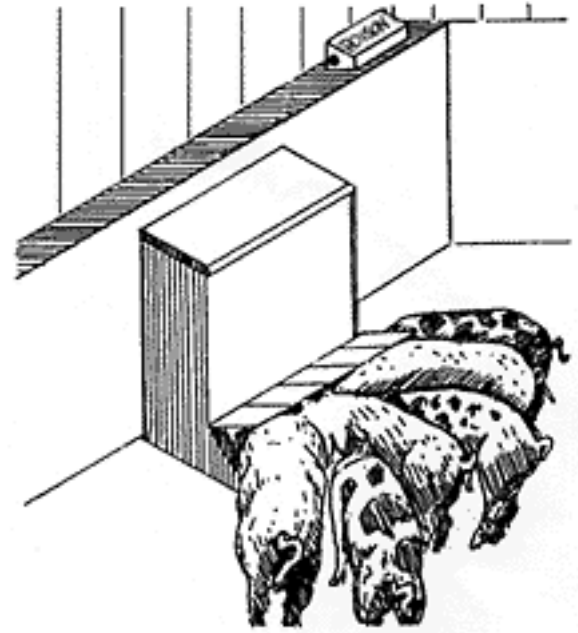
Proper placement of bait stations is just as important as using the appropriate bait. Rats and mice will not visit bait stations, regardless of their contents, if they are not conveniently located in areas where rodents are active.

Where possible, place bait between the rodents' source of shelter and their food supply. Put bait stations near rodent burrows, against walls or along travel routes used by the pests. Look for signs of activity such as droppings, gnawing, tracks and rubmarks. Rodents will usually not go out of their way to find baits. House mice seldom venture more than a few feet from their nests or food, so place bait stations no more than 10 or 12 feet apart in areas where mice are active. Rats are often suspicious of new or unfamiliar objects. It may take several days for rats to enter and feed in bait stations.

Figure 5. Rodent bait station attached to the top of a pen dividing wall in a swine containment facility. Such bait stations must be securely fastened and kept out of pigs' reach.

On farmsteads, bait station placement depends on building design and use. For example, in swine confinement buildings it may be possible to attach bait stations to wall ledges, or to the top of pen dividing walls. Bait stations can also be placed in attics, along walls, or in alleys where rodents are active (*Figure 5*).

Never place bait stations where livestock, pets or other animals can knock them over. Spilled bait may be a potential hazard, particularly to smaller animals. Rodent baits are poisonous to all animals to some degree. Pigs and dogs are especially susceptible to anticoagulants.



Where buildings are not rodent-proof, permanent bait stations can be placed inside buildings, along the outside of building foundations, or around the perimeter of the area. Maintain the bait stations regularly with fresh anticoagulant bait to keep rodent numbers at a low level. Rodents moving in from nearby areas will be controlled before they can reproduce and cause serious damage.

For more information on rodent control, see NebGuide [G94-1217, Rodent-Proof Construction: Drains and Feeding Equipment](#)



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G92-1106-A



Controlling Rats

Ways to recognize rat problems and control rats are covered here.

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The Norway rat (*Rattus norvegicus*) (also known as the common brown rat) is a destructive pest. Found in and around towns and farms throughout Nebraska, these rodents eat and contaminate large amounts of feed, damage structures by their gnawing and burrowing, and spread diseases that affect livestock and humans.

Recognizing Rat Infestations

Rats can be detected by their droppings or evidence of fresh gnawing. Tracks can be seen in mud and on dusty surfaces. Burrows and runways may be found next to buildings, along fences, and under low vegetation and debris.

Rat Facts



Norway rats are robust rodents that usually weigh about 11 ounces. Adults are 13 to 18 inches long, including a 6- to 9-inch tail. Their fur is coarse, brownish and scattered with black hair on the upper surfaces. The belly fur is typically gray to yellowish-white, and they sport a naked, scaly tail.

Norway rat, *rattus norvegicus*

Rats will eat nearly anything, but they prefer high-quality foods such as fresh grain, livestock feed, and meat. Rats require 1 fluid ounce of water daily when

feeding on dry food.

Rats have keen senses of hearing, smell, taste and touch. They will climb to find food or shelter, and can gain entrance to a building through any opening larger than 1/2 inch in diameter.

Rats have litters of six to 12 young, which are born 21 to 23 days after mating. Young rats are sexually mature in about three months. Breeding occurs mostly in spring and fall. The average female has four to six litters per year. Individuals usually live 12 to 18 months.

Rat Control

Sanitation. The presence of garbage and other refuse allows rats to exist in residential areas. Good sanitation will not eliminate rats under all conditions, but will make the environment less suitable for them to thrive. This involves proper storage and handling of food materials and refuse, and elimination of rodent shelter.

Figure 1. A 12-inch (30 cm) white painted band makes inspection for rodent sign easier and reminds personnel to practice good sanitation.

It is difficult to remove all food rats can use on farms where food grains are handled and stored, or where livestock are housed and fed. In such situations, you can still remove the shelter rats use for hiding, resting and nesting.



Warehouses, grain mills, elevators, silos and corn cribs are especially vulnerable to rodent infestation.

Store bulk foods in rodent-proof buildings, rooms, or containers whenever possible. Stack packaged food on pallets with adequate space left around and under stored articles to allow inspection for rat sign (*Figure 1*).

Rodent-proof construction. The most successful and permanent form of rat control is to "build them out" by eliminating their access to structures. Ideally, all places where food is stored, processed or used should be rodent-proof.

Seal any openings larger than 1/4 inch to exclude both rats and mice. Openings where utilities enter buildings should be sealed tightly with metal or concrete. Wood, plaster and caulk will not keep rats out. Equip floor drains and sewer pipes with tight-fitting grates that have openings less than 1/4 inch in diameter. Doors, windows and screens should fit tightly. It may be necessary to cover edges with sheet metal to prevent gnawing. For more information, refer to NebGuide [G94-1217, Rodent-Proof Construction: Drains and Feeding Equipment](#).

Rodenticides. Single-dose and multiple-dose rodenticides (toxic baits) and fumigants are registered for rat control. A wide variety of active ingredients and formulations are available. We recommend you use commercially-prepared materials, because they do not require applicators to handle concentrated materials that are more hazardous.

Single-dose rodenticides. Single-dose rodenticides are more hazardous than the multiple-dose (anticoagulant) rodenticides. Therefore, single dose toxicants should be used by professional pest control operators or other persons familiar with their use. Single-dose rodenticides (*Table I*) will give a quick knockdown of a rat population. They may be preferred where rats are abundant or where it is difficult to get rats to accept a bait for several days in succession because of competing food items.

Bait acceptance can be increased by "prebaiting" with unpoisoned bait for several days before the rodenticide is offered. If acceptance of prebait is poor, do not apply toxic bait, but change bait material or its placement. "Bait shyness" can occur with some single-dose rodenticides such as zinc phosphide, so it is best to use them only once per year at any location.

Remove and destroy all uneaten bait at the end of a poisoning program. Never leave single-dose baits exposed for more than three to four days.

Table I. Single-dose rodenticides and the percent of active ingredient commonly used for rat control.

Common name	Chemical name	Percent active ingredient used in food bait

Bromethalin (Assault®, Trounce®)	N-methyl-2,4-dinitro-N-(2,4,6-tribromophenyl)-6-trifluoromethyl)benzenamine	0.005 - 0.01
Cholecalciferol, Vitamin D ₃ (Quintox®, Rampage®)	9,10-Seocholesta-5,7,10(19)-trein-3-betaol	0.075
Zinc phosphide (ZP®)	zinc phosphide	1.0 - 2.0

Multiple-dose (anticoagulant) rodenticides. Multiple-dose rodenticides (*Table II*) generally are considered much safer than single-dose rodenticides. Anticoagulants cause death as a result of internal bleeding, which occurs as the animal's blood loses the ability to clot and capillaries are damaged. The active ingredients are used at very low levels, so bait shyness does not occur when using properly formulated baits.

Rats must feed on most anticoagulant baits for several days before death will occur. Fresh bait must be made available to rats continuously for at least two weeks, or as long as feeding occurs. There are exceptions, however, such as brodifacoum and bromadiolone, that are capable of causing death after a single feeding, but the rats do not die for several days. Vitamin K is an antidote for several anticoagulant rodenticides.

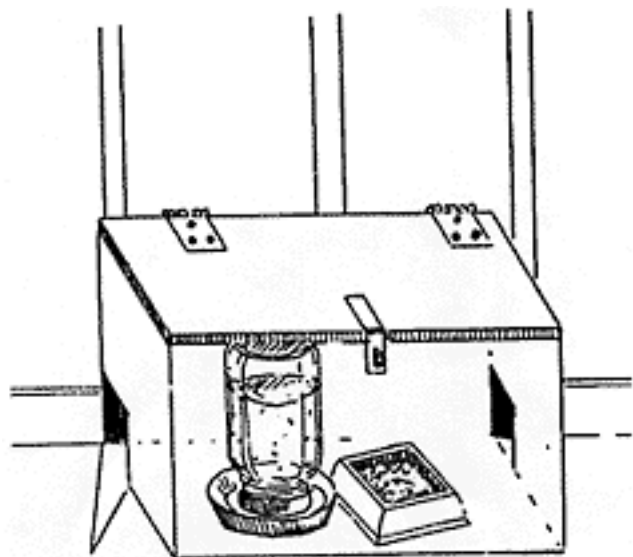


Figure 2. A homemade rodent bait station can contain liquid as well as solid (cereal) baits.

Bait selection and placement. Several types of anticoagulant baits are available. Grain baits or pelleted forms often are purchased in bulk or packaged in small plastic, cellophane or paper packets. These "place packs" keep baits fresh and make it easy to place baits into burrows, walls, or other locations. Rats readily will gnaw into place packs and feed on baits.

Anticoagulant baits formed into paraffin blocks are useful in damp locations such as sewers or gutters, where loose grain baits spoil quickly. Unfortunately, they are not accepted by rats as readily as other baits.

Anticoagulants also are available as sodium salts that are mixed into a water solution. Since rats require water daily, they sometimes can be drawn to water stations. Water baits are particularly effective in grain storage structures, warehouses and other locations where water is scarce.

Table II. Multiple-dose (anticoagulant) rodenticides and the percent active ingredient usually found in food baits for rat control.

Common name	Chemical name	Percent active ingredient used in food bait
Brodifacoum (Havoc®, Talon-G®)	3-{3-[4'-bromo(1,1'-biphenyl)-4-yl]-1,2,3,4-tetrahydro-1-naphthalenyl}-4-hydroxy-2H-1-benzopyran-2-one	0.005
Bromadiolone (Maki®, Contrac®)	3-{3-[4'-bromo(1,1'-biphenyl)-4-yl]-3-hydroxy-1-phenylpropyl}-4-hydroxy-2H-1-benzopyran-2-one	0.005
Chlorophacinone (RoZol®, AC 90)	2-{(p-chlorophenyl)phenylacetyl}-1,3-indandione	0.005
Diphacinone (Ramik®, Bait Blocks®)	2-diphenylacetyl-1,3-indandione	0.005
Pivalyl, Pindone (Pival®, Pivalyn®)	2-pivalyl-1,3-indandione	0.025
Warfarin (d-Con®)	3-(a-acetonylbenzyl)-4-hydroxycoumarin	0.025
Warfarin + sulfaquinoxaline (Proline®)	3-(a-acetonylbenzyl)-4-hydroxycoumarin + quinoxaliny sulfanilamide	0.025

We highly recommend the use of bait stations when applying any toxic bait (*Figures 2, 3*). They protect rodenticides from weather and provide a safeguard to people, pets and other animals. Rat bait stations should have at least two openings about 2 1/2 inches in diameter and should be large enough to accommodate several rats at a time. Place bait boxes next to the walls (with the opening close to the wall) or in other places where rats are active. Label all bait boxes clearly with the words "Caution -- Rat Bait" as a safety precaution.

Establish bait stations in or around the perimeters of buildings where it is impossible to exclude rodents. Place fresh anticoagulant bait in these stations to control invading rats before breeding populations become established. For more information, refer to NebGuide [G94-1215, Bait Stations for Controlling Rats and Mice](#).

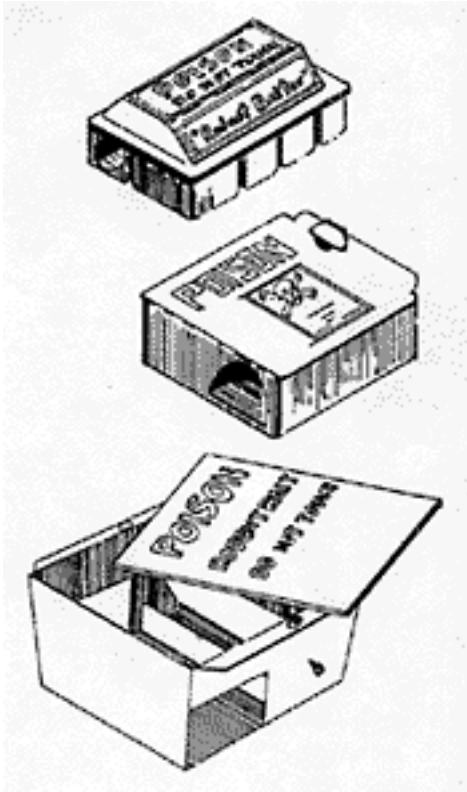


Figure 3. Examples of commercially manufactured rodent bait stations.

Fumigants. Fumigants occasionally are used to treat rodents' burrows in outdoor situations. Aluminum phosphide tablets and gas cartridges are the most commonly used, registered fumigants for treating rat burrows.

Caution: Fumigants are highly toxic to humans, livestock and other animals, and must not be used where occupants of a building could be exposed to the gases. Only licensed structural pest control operators should use fumigants in any buildings or enclosed structures.

Safety precautions. Carefully follow all product label recommendations. In addition, certain general safety precautions should be followed. Consider all rodenticides dangerous enough to cause death, and place baits where only rodents can access them. All rodenticides present some degree of hazard to humans, livestock, pets and other non-target animals.

People who formulate rodent baits for their own use should use extreme care in handling materials. Rubber gloves, an apron and a proper respirator should be worn. Wash thoroughly using soap, a brush and plenty of water after preparing baits. Clean all bait-mixing utensils thoroughly and use them only for bait preparation.

Label all bait containers and bait stations clearly with appropriate warnings. Store unused bait, concentrates, and fumigants in a locked cabinet out of the reach of children or animals. Pick up all accessible dead rats after a poisoning program. Use rubber gloves or tongs and dispose of them by deep burial or incineration.

Traps. Trapping can be an effective method of controlling rats, but it requires more skill and labor than most other methods. Trapping is recommended where toxicants are inappropriate. It is best to try trapping first in homes, garages, and other small structures where there may be only a few rats present. Trapping has several advantages: 1) it does not rely on inherently hazardous rodenticides; 2) it permits the user to view his or her success; and 3) it allows for disposal of trapped rats, thereby eliminating odor problems which may occur when poisoning is done within buildings.

Simple, inexpensive wood-based snap traps are available at most hardware and farm supply stores. Wire cage traps are more expensive but somewhat more successful than snap traps.

Bait traps with peanut butter or a small piece of hot dog, bacon or pizza tied securely to the trigger. The trigger should be set lightly so the trap will spring easily. Leave traps unset until the bait has been taken

at least once to reduce the chance of rats becoming trap-shy. Set traps close to walls, behind objects, in dark corners and in places where rat sign or activity is observed. Place traps so rats will pass directly over the trigger when following their natural course of travel. Use enough traps to make the effort short and decisive.

An alternative to traps are glue boards, which catch and hold rats attempting to cross them in much the same way flypaper catches flies. Place glue boards along walls or in other areas where rats travel. Do not use them where children, livestock, pets or desirable wildlife can contact them. Glue boards lose their effectiveness in dusty areas unless covered. Extreme temperatures also may affect the tackiness of the glue boards.

Electronic devices. Rats quickly become accustomed to regularly repeated sounds. Ultrasonic sounds, those above the range of human hearing, have very limited use because they are directional and do not penetrate behind objects. They also lose their intensity quickly with distance. There is little evidence that electronic, sound, magnetic, or vibration devices of any kind will drive established rats from buildings or provide adequate control.

Predators. Although house cats, some dogs, and other predators kill rats, they do not provide effective rat control in most circumstances. Rats often live in very close association with dogs and cats. Rat problems around homes are often related to the food, water and shelter provided for the pet.

To simplify information, trade names of some products have been used in the text and tables. No endorsement of named products is intended, nor is criticism implied of similar products that are not mentioned.

If mouse control is also a problem, see [NebGuide G92-1105, Controlling House Mice](#).

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