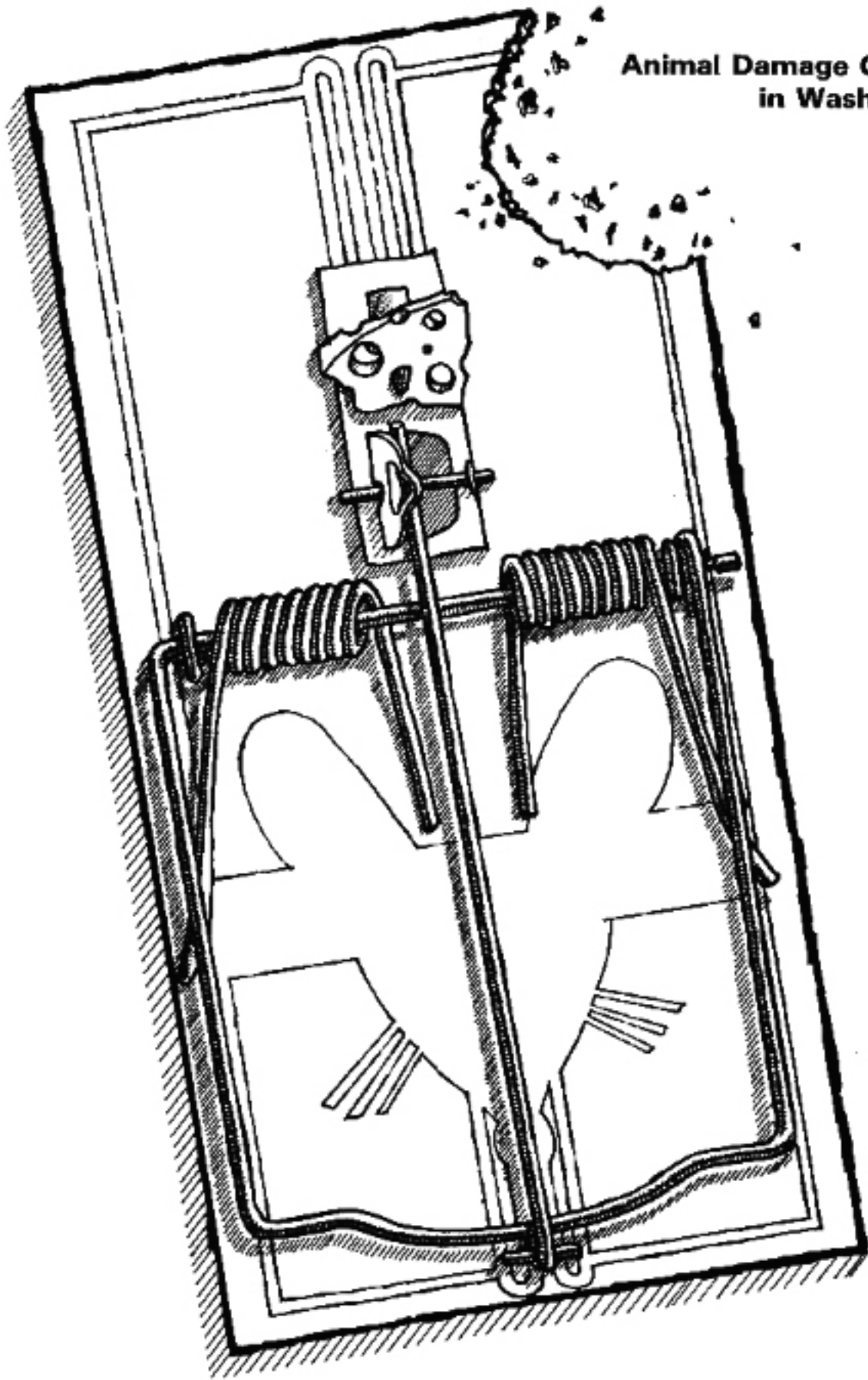


**Animal Damage Control  
in Washington**  
EB 1147



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### *Caution*

To the best of our knowledge the suggested uses of pesticides in this publication are consistent with directions on product labels. If there is an apparent conflict between these suggestions and label directions consult your county Extension agent. The label is the legal and final authority. The law requires that *pesticides be used in accordance with directions on the label*. Uses against pests not named on the label and lower application rates are permissible exceptions.

Use pesticides with care. Apply them only to plants, animals or sites listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

Compiled by David M. Baumgartner, Extension Forest Resources Specialist, and Leonard R. Askham, Vertebrate Pest Management Specialist. Reviewed by the Fish and Wildlife Service, U.S. Department of Interior. Issued by Washington State University Cooperative Extension, J.O. Young, Director, and the U.S. Department of Agriculture in furtherance of the Acts of May 8 and June 30, 1914. Cooperative Extension programs and policies are consistent with federal and state laws and regulations on nondiscrimination regarding race, color, religion, national origin, sex, age, and handicap. Trade names have been used to simplify information; no endorsement is intended. Chemical registrations are subject to change. Before using any chemical, be certain that chemical is registered for the intended use. Replaces EM 3908. Revised July 1985. \$2.50.

## INTRODUCTION

Vertebrates, such as rats, mice, coyotes, deer, bats, and snakes, sometimes become pests requiring control. Chemicals are a frequently chosen alternative for control. Chemicals used to control all vertebrates, including rodents, are subject to registration under provisions of the Federal Insecticide, Fungicide, and Rodenticide Act. Under this act—"the term rodenticide means any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating rodents or any other vertebrate animal which the Secretary shall declare to be a pest."

Before initiating any control action, a person should be absolutely certain that these actions are necessary. The following factors should be evaluated:

1. Identify the animal causing the damage.
2. The amount of damage occurring and anticipated to occur without control.
3. Benefits of control vs. their cost.
4. Any aesthetic or recreational value of the species involved.
5. The effect of a control program on nontarget animals and the environment.

Once the decision has been made to initiate control actions, alternative methods of control should be evaluated. With the growing concern over the use of chemicals and their effects on the environment, mechanical control techniques should be strongly considered. Depending on the situation and the pest involved, traps, physical barriers, noisemakers, shooting, or other nonchemical control methods may be suitable.

Before initiating chemical control activity, the appropriate regulatory agency should be contacted about registration status and use limitations of chemicals under consideration.

The perfect chemical is one which will eliminate, repel, or change the habits of the animal for which it was intended without endangering man, other animals, or the environment. A good rodenticide is toxic enough to kill pests with small amounts and it should be acceptable to the pest so it will be taken in lethal portions. There are many characteristics that may serve as a basis to qualify, limit, or restrict the use of a rodenticide. For example, relative toxicity, selective animal toxicity, speed at which it kills, secondary poisoning, mode of action, and hazard to the operator are important traits. The chemical properties, such as solubility, corrosiveness, odor, compatibility, stability to air, temperature, and sunlight must also be considered.

# ***Agricultural Animal Damage Control***

## ***Rats***

Most rats live in the slums and sewers of the major urban centers, true?

False! That's a common belief, but one that is simply not so. Most sources agree that the United States has a rat population roughly equal to the human population, or about 240 million rats. It's estimated that about half of the rat population lives on farms, with the rest split between large urban areas and the suburbs.

City rats get more attention. Federally-subsidized programs have poured millions of dollars into rat control in the major urban centers. State, county, and city governments spend additional hundreds of thousands of dollars annually.

Meanwhile, America's farmers often live in peaceful coexistence with sizeable rat populations—spending many times the cost of control, but never knowing it. The World Health Organization estimates rats devour or spoil more than three million tons of stored grains around the earth each year—enough to feed 200 million people. In this country alone, the Public Health Service blames rats for property losses of up to one billion dollars annually. The Department of Agriculture says each rat on a farm can cost the farmer \$25 a year—far more than the cost of control.

Rats gnaw through electrical cables, causing fires and the resultant loss of animals, feed, equipment, and buildings. They maim and kill poultry and other farm animals. They spread human diseases like salmonellosis, rabies, tularemia, leptospirosis, amoebic dysentery, typhus, jaundice, and trichinosis, as well as many others which affect livestock.

Loss to farmers from these and other diseases is immeasurable. Often, farmers spend many dollars in programs to keep livestock buildings disease-free. Equipment and facilities are sterilized. New livestock is segregated. Health papers are demanded. Visitors to and from the farm are required to wear sterile boots or walk through a pool of disinfectant. And the rats are allowed to come and go at will.

Even when livestock buildings are rat-proofed, feed, bedding, and equipment are often stored in rat-infested areas and provide a continuing source of contamination to the livestock. So a farmer doesn't have rat control anywhere until he has it everywhere.

The rats themselves provide most of the rat control in force on most farms. The size of any rat colony is dependent on how much food, water, and shelter are available close at hand. The number of rats the "life support system" sustains is absolute—it may be 100, 500, or 1,000. The rats are always working to maintain that number, alternately building up and cutting down the population.

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This material covering Farm Rat Control is adapted from the publication *Farm Rodent Control* prepared by Reiman Associates of Milwaukee, Wisconsin, for the Velsicol Chemical Company. Our sincere appreciation for the use of this material goes to Reiman Associates and Velsicol.

This fact is well illustrated when you consider the estimated farm rat population, and the ability of the rat to reproduce. They can start to breed as early as a month after birth, and females usually have from 7 to 10 litters of 8 to 12 or more per year. If they lived for three years, a pair of rats could theoretically produce 350 million offspring—or some three and a half times the present estimated farm-rat population.

When the birth rate spurts and the colony overpopulates, the strongest rats kick the weaker ones out. These castoffs either die from exposure or lack of food or water, are eaten by predators, or migrate to other spots where food, water, and shelter are plentiful. This is frequently a farm where a good, rat-control program was started, then stopped, and so made room for more rats. A new colony is started and the cycle repeats itself.

### Characteristics of Norway Rat and Roof Rat

The most common U.S. rat is the Norway rat, *Rattus norvegicus*. Norway rats vary in color from reddish brown to grayish and almost black; they weigh from 10 to 17 ounces. It is also called the brown rat, house rat, barn rat, sewer rat, wharf rat, etc. It's found nearly everywhere, and picks up local names accordingly. The roof rat, *Rattus rattus*, distinguished by having a tail larger than its head and body, is present in lesser numbers, primarily along the coast.

Their front teeth grow at the phenomenal rate of five inches per year, so they have to gnaw constantly to keep their incisors worn down. If they don't, the teeth curve back and jam their mouths open—permanently, and they die of starvation. Consequently, you'll find evidence of rats chewing through pipes, several inches of concrete, bricks, hardwood planks, metal siding, etc., simply as a matter of survival. While they're traveling or nesting, they're continually gnawing and gobbling.

Norway rats generally build their nests in burrows or at ground level; whereas, roof rats make nests in trees, dense vegetation, or attics of buildings. Young rats are born in a nest about 21 to 23 days after mating. They are naked and their eyes are closed. The mother may mate again within a day or two of littering. When this occurs, the gestation period may be a few days longer than normal.

The young rats develop rapidly, growing hair within a week. At 9 to 14 days their eyes open, and they begin to explore for food and move about near the nest. In the third week they begin to eat solid food.

Young rats may continue to nurse until 4 or 5 weeks old. By this time they have learned a good deal about what is good to eat by experimenting with potential food items and by imitating their mother. If a mother rat has become shy to a specific kind of bait or rodenticide, many of the young will learn to avoid eating it.

At about 3 months of age, they are completely independent of the mother and are reproductively mature. The females come into heat every 4 or 5 days and remain receptive to males for a day or two. Breeding seasons vary in different areas. In warm regions the season may be continuous, but litter sizes may be smaller. In much of the temperate region there may be peaks in the breeding in the spring and fall. There is a lessening of breeding in the hot summer, and nearly a complete cessation in winter, depending on the habitat.

The size and number of litters depends on the species of rat and varies with the climate, availability of food, density of the local rat population, and age of the rat. Norway rats generally have litters of 6 to 12.

Most rats are quite omnivorous, eating nearly any type of food, although each kind of population has its own preferences. The Norway rat is an avid consumer of man's garbage; whereas, the roof rat generally prefers more natural plant food, if available. They all feed to varying degrees on cereals, nuts, fruits, vegetables, invertebrates, fish, and even manure, depending on the habitat conditions.

The only sure way of determining the preferred food of a local population of rats is to conduct bait acceptance or feeding tests with nontoxic foods. There seems to be no universally preferred diet. For example, Norway rats in eastern United States seem to prefer cornmeal over oats, whereas, the reverse is true in at least part of the western United States and Canada.

Rats usually begin searching for food shortly after sunset. When hungry, or under crowded conditions, they may also be seen in daylight. If food is in an exposed area and too large to be eaten quickly, yet not too large to be moved, they will usually carry or drag it to a hiding place before eating it. Many rats will cache or hoard considerable amounts of solid food, which they may or may not eat later. The water requirement varies with species and diet, but most rats drink water regularly if it is available.

When rats approach a food item for the first time, they may be cautious feeders. For this reason, prebaiting with a nontoxic bait will often enhance later acceptance of a toxic bait. The most acceptable bait is frequently a local food the rats have already become accustomed to. Totally different types of food may be highly preferred, particularly if they fulfill a dietary need for the particular rat population.

Rats are considered to be colorblind, responding only to the degree of lightness and darkness of colors. Thus, for safety reasons, baits can be made various colors without modifying their acceptability by rats, assuming the coloring agent does not have an adverse taste or odor. Rats see poorly, relying more on smell, taste, touch, and hearing.

They use their keen sense of smell to locate food items and apparently to recognize other rats, especially those of the opposite sex. Taste perception of rats is quite good, and Norway rats can easily detect some nontoxic compounds at extremely low levels (0.5 ppm) in their diets. Once they have tasted a food item, taste probably overshadows any affect of the odor.

Rats recognize noises and use their acute hearing to detect and escape danger. Another important sensory factor with rats is touch. The long, sensitive whiskers (vibrissae) near their nose and the guard hairs on their body enable them to travel in the dark adjacent to walls and in burrows.

Keeping the barn door closed won't keep rats out. In fact, it's nearly impossible to rat-proof many older farm buildings when you consider that rats can do the following:

- Gain entrance through any opening that is larger than 1/2 inch (1 1/4 cm) square.
- Climb both horizontal and vertical wires.
- Climb the inside of vertical pipes that are 1 1/2 to 4 inches (4 to 10 cm) in diameter.
- Climb the outside of vertical pipes and conduits up to 3 inches (7 1/2 cm) in diameter.
- Climb the outside of vertical pipes of any size if the pipe is within 3 inches (7 1/2 cm) of a wall or other continuous support of the rodent.
- Crawl horizontally on any type of pipe or conduit.
- Jump vertically as much as 36 inches (.9 meter) from a flat surface.
- Jump horizontally 48 inches (1.2 meters) on a flat surface.
- Jump horizontally at least 8 feet (2.4 meters) from an elevation 15 feet (4.5 meters).
- Drop 50 feet (15 meters) without being killed or seriously injured.
- Burrow vertically in earth to a depth of 4 feet (1.2 meters).
- Climb brick, or other rough exterior walls which offer footholds, to gain access to upper stories of structures.
- Climb vines, shrubs, and trees, or travel along telephone or power lines to gain access to upper stories of buildings.
- Reach as much as 13 inches (33cm) along smooth, vertical walls.
- Swim as far as 1/2 mile (0.8 kilometers) in open water, dive through water plumbing traps, and travel in sewer lines even against substantial water currents.
- Gnaw through a wide variety of materials including lead sheeting, sun-dried adobe brick, cinder blocks, and aluminum sheeting.

#### **Determining Presence of Rats**

Following are eleven signs which can alert farmers to the presence of rats:

*Sounds.* Gnawing, clawing, climbing in walls. various squeaks and fighting noises.

*Droppings.* May be found along runways, near shelters, or other places rats frequent. Fresh droppings are soft in texture.

*Holes.* May be found under edges of buildings and along fences.

*Urine.* Wet and dry rodent urine stains on various material will fluoresce under ultraviolet light. Remember that some other materials also may fluoresce in ultraviolet light, which can be confusing.

*Smudge marks.* May be found on pipes and beams where dirt and oil from their fur leave smudge marks.

*Runs.* May be found next to walls, along fences, under bushes and buildings, and where their feet make beaten paths on the ground or through grass. Runs within buildings may be well-polished trails that are free of dust.

*Tracks.* Footprints or tail marks may be found on dusty surfaces. The use of nontoxic tracking dust, such as talc, will help determine the presence of rats within buildings. When used outdoors, the dust must be protected from wind, rain, and other animals.

*Gnawing.* May be indicated by wood chips around baseboards, doors, windows and frames, stored materials; around pipes in floors and walls; and wherever rats might try to enlarge a crack or enter something. Tooth marks on gnawed materials provide evidence of rodent damage. Frequently the size of the tooth marks will assist in identifying the species involved.

*Visual sightings.* Observation of rats during daylight hours generally indicates that a high or moderately-high population exists in that area. Nighttime observations with the aid of a powerful flashlight or spotlight is often helpful.

*Nests and food caches.* Can sometimes be found when cleaning garages, attics, basements, closets, and other storage places. Roof rats, as well as other rodent species (i.e., squirrels, and packrats), often store food in attics of buildings.

*Pet excitement.* Cats and dogs may excitedly probe an area of floor or wall where rats are present, especially if rats have just recently invaded the premises.

*Rat odors.* The presence of rat odors in a room may provide a clue to their presence. With a little experience, the odors of house mice can be readily differentiated from those of rats.

Rats feed almost invariably at night. Any food that you or domestic animals eat is good fare. And they have excellent taste! While they can thrive on garbage or tainted food, they'll choose fresh meals when given the choice. This means that if you are going to poison them, you must use a bait that tastes as good or better than anything else around. If you're feeding a 22 percent protein poultry ration, the rat bait should contain at least 24 percent protein if you expect it to be eaten.

Rats are careful about eating strange foods, and may sample it in small amounts. If it is poisoned, and there are any side effects, a rat will eat no more. What's more, he'll warn other rats not to eat it. Even if a rat dies of the poison, his remains can serve as a warning to others. This is why a fast-acting toxicant will not give needed control.



Another problem with highly toxic baits is the high birth rate which follows an apparently successful 70 or 80 percent kill. Unless there is continuous follow-up, the rat population skyrockets beyond what it was in the beginning. Then it works its way down again, and you have what you started with.

The use of acutely toxic poisons should be left in the hands of professional, pest-control operators. Besides the problems of safety, bait shyness usually prevents achieving acceptable control in the hands of an amateur.

There is a greater hazard in using quick-kill rat baits. Most acute rodenticides are very dangerous to humans and nontarget animals. There can be cases of secondary poisoning, in which a cat or dog dies after eating a rat that has been poisoned. Absorption of the poison through the skin can be a problem to humans.

### Steps to Control

Keeping rats from gaining a foothold on a farm is a year-round job involving proper use of rodenticides *plus* denying the rodents food and shelter. This involves four basic steps:

1. A continual cleanup campaign around the farm, to deny rats comfortable living and breeding places.
2. Rat-proofing home and out-buildings mechanically.
3. Baiting the home, barns, garages, corn cribs, chicken houses, hog houses, machine sheds, etc.
4. Perimeter baiting on the outskirts of the farmyard, at least 100 feet from buildings.

Many rodent control experts recommend using anticoagulant baits. All are readily available in ready-made baits.

With anti-coagulants, rodents die slowly and painlessly enough that they never really catch on to what is happening. This eliminates the problem of bait shyness.

Warfarin is still just as effective as ever with the vast majority of common rats. There is no truth to opinions advanced in recent articles and promotional material that rats in general are becoming immune to Warfarin. The compound is as effective as ever in the United States, except with a particular strain of rat which has developed in an isolated area in North Carolina. This strain seems to be contained, and its members are short-lived. There is no real evidence at all that Warfarin is any less effective with most rats.

### *Outdoor Baiting Problem*

The best-prepared baits made with table-grade materials are still subject to spoilage once they get wet. When this happens, rats will pass up the bait for other foods. Rats have to be desperate to eat anything that is moldy, rancid, or infested with insects. Weatherproof baits are therefore

very important for outdoor baiting. . .and good control is never achieved indoors unless it is also achieved outdoors. Under some conditions, even indoor placements might be made under conditions of high humidity, making the bait unacceptable. Baits are available that will maintain their acceptance and effectiveness outdoors for as long as 30 days.

### *Bait Stations*

Using bait stations to hold bait will help keep it out of reach of children and nontarget animals. Stations should be made out of solid materials that won't be crushed or knocked out of place and should be firmly anchored to the ground, wall, or floor. Ready-made stations are available in most hardware and farm-supply stores, or plans for building them are usually available through county agents.

Bait stations are usually open at both ends, allowing rats to travel through them. Stations should be placed about 20 feet apart along walls in areas where rats are suspected. A rat will travel only about 100 feet to get food, but only a few feet if that's all that's necessary. So, the more stations, the better the chances of station traffic.

For perimeter baiting, waterproof stations should be placed along fences, waterways, woodpiles, drainage ditches . . . anyplace where wandering rats might find food, shelter, and water. Stations should also be placed where there is the least chance of disturbance by people or animals.

### *Rat-Proofing Buildings*

Concurrent with a baiting program, it's advisable to close off any access routes into farm buildings, and to eliminate places where rats might find shelter. Here are some examples:

Close openings over 1/2 inch in diameter. Rats can get their teeth into these and enlarge them, thus gaining access. Cement up openings around pipes. Close holes around floor drains, and keep drains tightly covered.

Cover edges subject to gnawing with heavy sheet metal or wire mesh. The bottoms of doors are a good example.

Keep doors closed when not in use, using good springs to close them, and spring locks to make sure they stay closed.

To make sure rats don't climb, put a 12-inch band of sheet metal in corners, a foot or so above ground or floor level.

To rat-proof a slatted corn crib, put 1/2-inch wire netting around it to a height of 2 feet from the top of the foundation. Above that, fasten an 8-inch band of sheet metal. Use galvanized sheet metal at the edges of doors.

### *Limit Food, Water, Shelter*

Keep garbage and trash in tightly-covered metal or heavy plastic containers. Don't leave any feed in the open. Keep all feed in buildings that are as rat-proof as possible.