



# AGRI-FACTS

Practical Information for Alberta's Agriculture Industry

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## Mice and Their Control

**M**ice are a large group of mammals, with more than 130 species found worldwide. In Alberta, there are seven species of mice and 12 species of voles.

The most troublesome and economically important of the species found in Alberta are the house mouse, the white-footed mouse and the meadow vole (commonly called field mouse).

### Economic losses to mice

There is no way of placing a monetary value on human suffering and damage caused by mice. The greatest loss is probably not what mice eat, but what is wasted and contaminated.

In six months, one pair of mice can eat more than two kilograms (4 lbs.) of food and deposit about 18,000 droppings. Food contaminated by mice is about ten times greater than what is eaten. Also, food wasted by mouse nibbling is much more than what is eaten. So common are mice, that it is no wonder their hairs and sometimes droppings, end up in all types of food commodities, from canned beans to loaves of bread.

Structural damage caused by rodents can be expensive. In recent years the trend toward use of insulated confinement facilities to raise swine and poultry, for instance, has led to increased rodent damage. Mice are very destructive to rigid foam, fibreglass batt and other types of insulation in walls and attics of such structures.

Mice also gnaw wooden structures causing grain and feed to be wasted. They also undermine buildings by burrowing, which eventually causes structural failure and collapse.

Electrical wiring gnawed by mice causes many fires each year, listed as "cause unknown".

### Public health impact

Mice and their parasites are implicated in the transmission of a number of diseases including salmonellosis, rickettsialpox and most recently hantavirus. Bacterial food poisoning occurs when foods are contaminated with infected rodent droppings. Mice also carry many types of tapeworms and roundworms, infectious to pets and humans.

Hantavirus pulmonary syndrome (HPS), which causes severe illness and even death in humans, is transmitted by several mouse species including the white-footed mouse.

To reduce the risk of contacting organisms transmitted by mice, you should practise these common sense precautions:

*Food contaminated by mice is about ten times greater than what is eaten*

- Eliminate mice from residential areas by removing food sources and access for mice.
- Clean up mouse-contaminated areas by using wet methods, including disinfectants such as bleach.
- Handle mice and other rodents with gloved hands.
- Avoid sweeping and vacuuming when possible, or wear a dust mask to reduce exposure to fine dust particles.
- Campers should avoid obviously infested areas.
- In high risk areas wear a high efficiency, particulate respirator (i.e. 3M model 9970).
- Discourage children from playing with or trapping mice and should not keep wild mice as pets for "science projects"
- De-worm household and farmyard pets regularly.

## Identification

The house mouse is a delicate, agile, little rodent. It has a slightly pointed nose; relatively small feet; small, black, somewhat protruding eyes; large, sparsely-haired ears; and a nearly hairless tail about as long as its body, with obvious scale rings. They vary in colour but are generally grayish-brown throughout with a gray or buff belly.

Adults weigh 10-30 g (2/5 to one oz.) and measure 65 to 90 mm (2 1/2 to 3 3/4 in.) in total body length, including the tail.

The house mouse is not native to North America. It originated from Asia, arriving and travelling across North America with settlers from Europe and elsewhere.

A very adaptive species, the house mouse depends upon man for shelter and food, particularly in cooler climates, and this close association with humans classifies it as a “commensal rodent” (like the Norway rat).



Figure 1. The house mouse

The white-footed mouse or deer mouse is a native species with white feet, white or light-coloured undersides, and brownish upper surfaces. The tail is distinctly bi-coloured; the upper portions brown or gray, the underside white, with a well-defined line where the two colours meet. White-footed mice are about the same size as, or slightly larger than house mice and, at a distance, may be confused with house mice. The bi-coloured tail differentiates one from the other. In comparison to house mice, white-footed mice have larger eyes and ears. They are considered by most people to be more “attractive” than house mice, and they do not have the characteristic mousy or musky odour of house mice.

The white-footed mouse measures 50-90 mm (2 to 3 1/2 in.) in length with an additional 50 to 88 mm (2-2 1/2 in.) tail and weighs up to 90 g (3 oz).



Figure 2. White-footed mouse (or deer mouse)

The meadow vole or field mouse is a compact, stocky rodent with short legs and a short tail. Its eyes are small and its ears are partially hidden.

The meadow vole has a dense undercoat and is the darkest-coloured mouse, ranging from dark gray to yellow-brown or red, obscured by black-tipped hairs. Body length is 63 - 94 mm (2 1/2 to 3 3/4 in.) with a relatively short tail that measures up to 50 mm (2 in.) long.

The meadow vole is rarely seen higher than ground level for it does not climb walls, roofs or attics, etc. like other mice.



Figure 3. The meadow vole or field mouse

## Food habits

Mice eat many types of food but prefer seeds and grains. Most mice species do not hesitate to eat new foods and, foods high in fat or sugar are the most sought after. Such items include bacon, chocolate, candies, butter and nutmeats. In late summer, white-footed and field mice often store quantities of food near their nest sites. Field mice occasionally eat snails, insects and animal remains.

## Life history

Mice are mainly nocturnal; however, house mice and meadow voles may be active during the day at some locations. Seeing mice during daylight hours does not necessarily mean that a high population is present, although this is usually true for rats.

Mice usually bear a litter of five to six young, following a 21 to 23-day gestation period. White-footed mice may have more than one litter per year, and house mice living indoors can have up to 10 litters per year.

Young mice are weaned at about 21 days, and females can mate at about 35 to 49 days. Lifespan is usually short, ranging from four to 20 months. Mice do not hibernate, but white-footed mice may become completely inactive for a few days when winter weather is severe.

The nest of a mouse is usually ball-shaped and consists of shredded fibrous material such as paper, burlap, and stems, leaves, twigs, etc. It may be lined with hairs, feathers and shredded cloth.

The meadow vole commonly constructs underground tunnels and surface runways with numerous entrances. Similarly, house mice construct runways under flat surfaces such as plywood, sheeting or boards.

White-footed mice spend a great deal of time in trees. Occasionally they re-furbish abandoned bird or squirrel nests, by adding a protective "roof" of twigs and leaves. Generally, all mice nest at, or below ground level, or in buildings.

Mice possess amazing physical capabilities that enable them to gain entry to structures by climbing, crawling, jumping or gnawing. Mice are also good swimmers, particularly meadow voles which are known to cross open water to seek food and shelter.

However, the house mouse out-performs all mice in physical capabilities which makes control of it more difficult. Also, house mice constantly explore their environment and can be found in a wider range of locations.

Most mice quickly detect new objects in their environment but, unlike rats, do not fear them. Therefore, they will almost immediately enter bait stations and traps or cross glueboards, and willingly sample new food items.

Studies indicate that mice normally travel within an area averaging 3 to 10 m (10 to 30 ft.) in diameter to obtain food, shelter and water.

## Damage caused by mice

Mice cause a wide variety of problems ranging from chewing upholstered furniture to girdling trees in orchards. Economic damage caused by mice can be categorized into three areas: food and feed consumption, structural damage to buildings, and, other damage related to their habits of chewing and digging.

Voles often girdle shelterbelt seedlings and native trees. Voles also eat crops and damage them when they build extensive runways and tunnel systems. All mice have a very keen sense of smell and can locate and dig up seeds buried 15 cm (6 in.) deep.

In addition to their destructive habits, mice, and particularly house and white-footed mice, are implicated in the transmission of several disease organisms. In 1993, the white-footed mouse was identified as a potential reservoir of a type of hantavirus responsible for an adult respiratory distress syndrome in western Canada.

## Damage prevention and control methods

Mice are considered non-game mammals and receive no protection under existing pertinent legislation. It is usually permissible to control them when necessary, but first check with local authorities and on rodenticide labels.

Effective prevention and control of mouse damage involves three aspects: rodent-proofing construction, sanitation and population reduction.

## Rodent-proofing

Mouse damage can be reduced by removing or limiting access to nesting areas, food sources and, escape and nesting areas.

Eliminate weed and other vegetative cover as well as debris and litter in and around homes, buildings, crops, lawns and other cultivated areas. Lawn grass and turf or orchard grass should be mowed regularly. Mulch should be cleared 1m (3 ft.) or more from the bases of trees.

Indoors, remove padded cushions from sofas and chairs, and store them on edge or separate from one another, off the floor. Remove drawers in empty cupboards or chests and re-insert them upside down.

Wherever possible, store bulk foods in sealed, rodent-proof containers or rooms. Stack bagged or boxed food in orderly rows on pallets in a way that allows for thorough inspection for evidence of mice. In storage areas, keep stored materials away from walls. Sweep floors frequently to permit ready detection of fresh mouse droppings.

Ditch banks, rights-of-way, and headlands need to be managed properly to control meadow voles which can reach very high numbers. Adjacent crops can be effectively protected by controlling nearby vegetation through mowing, grazing or spraying.

## Sanitation

Good housekeeping and good sanitation practices such as proper storage and handling of food material, feed and garbage will aid in control by permitting easier detection and increased effectiveness of traps and baits.

Mice are very adaptive to living with people. They require very little space and only small amounts of food. Mice have been known to inhabit buildings even before construction has been completed, living off the crumbs and scraps of workers' lunches.

In offices, house mice may live behind cabinets or furniture and feed on scraps or crumbs from lunches or snacks, candies, or even sugar granules found on desktops.

In homes, mice may find ample food in kitchens, garbage cans, garages and even the pet dish.

Eat only in areas designated for food consumption, and always clean up afterward. Do not invite mice by leaving food items or crumbs out overnight.

## Exclusion

Physical barriers can prevent mice from gaining entry to structures where food and shelter are available. To exclude mice, seal all holes and openings larger than 6 mm (1/4 in.) across. Rodent-proofing should be done with heavy materials that will resist rodent gnawing. These include concrete mortar, galvanized sheet metal and heavy gauge hardware cloth. To protect newly-seeded garden plots, use wire-screen caps or bowls, and press them into the soil several inches. Inverted strawberry baskets may also be used for small plants.

## Frightening devices

Mice can be frightened by unfamiliar sounds or sounds coming from new locations. However, they soon become accustomed to new sounds and lose their fear of them. Devices that emit very high frequency signals are uncomfortable to mice and have limits to their direction and travel distance, rapidly losing their intensity after leaving the source.

While it is possible to cause permanent physiological damage to mice with ultrasound, the intensity of such sounds must be so great that damage to humans or domestic animals would also be likely. For these reasons, ultrasonic and ultrasound devices are not recommended to effectively scare away mice.

## Repellents

Mice find some tastes and odours offensive, but chemical repellents are seldom a practical solution to mouse prevention or control of infestations. Substances such as naphthalene (mothballs or flakes) may repel mice from small, closed areas where sufficient concentration of the chemical can be attained in the air. Concentrated oils of mint, cedar and other aromatics have not proven effective in repelling mice.

## Population reduction

### Toxicants

Rodenticides are divided into two major groups of: **anticoagulants** and **other compounds**.

Anticoagulants, such as Warfarin, Rozol or diphacinone, comprise the vast majority of commercially available mouse poisons and provide good, to excellent mouse control. Some anticoagulants such as Warfarin, are manufactured as a solid (food) or as a liquid (mixed with water) bait. Water baits work very well where moisture is absent or temperatures are warm.

Newer anticoagulant baits such as brodifacoum and bromodialone can be more effective than other anticoagulants because of their potential to be lethal in a single feeding. These baits are capable of producing death in mice in a single meal.

**Check labels on containers before you buy to be sure you have the most suitable bait for your needs.**

Because of their similarity in mode of action, all anticoagulant baits are used in a similar fashion. Label directions commonly instruct you to maintain a

continuous supply of bait for 15 days or until all feeding ceases. This will ensure that the entire mouse population at the bait location has had ample opportunity to eat a lethal dose of the bait.

Anticoagulants have the same effect on all warm-blooded animals, but the sensitivity to these toxicants varies among mouse species. If misused, anticoagulant rodenticides can be lethal to livestock, pets and other non-targets.

The hazard of secondary poisoning to scavengers or pets eating anticoagulant bait-killed mice is relatively low. Always use extreme care when using any poison, particularly where pets, livestock or other non-targets can find it.

### **Non-anticoagulant toxicants**

Of the non-anticoagulant toxicants, strychnine and zinc phosphide (ZP) are among the oldest, and bromethalin and cholecalciferol, the newest. These baits are classed separately because they are a single-dose bait. They are not designed to be left available to mice for more than a few days, as continuous exposure may result in “bait shyness”.

Single-dose baits are recommended for quick population reduction and where anticoagulants cannot be safely set out for the required length of time.

Single-dose baits should only be used where anticoagulants are not feasible, because continued use usually results in bait shyness and increases the hazard of secondary poisoning to scavengers.

Where possible, safely dispose of all poison-killed mice, particularly those killed by single-dose baits, by putting them in garbage cans with tight-fitting lids.

### **Bait selection**

Food preferences may vary among mouse species and individual mice. Mouse baits that are similar to foods mice are accustomed to eating, are often more effective, particularly if their normal food supply is limited or can be made less available to them. To check for differences in bait preferences, place about 15 g (1/2 oz) of each different bait about 10 cm (4 in.) apart at two or three locations where mice are present. Check the next day to see which bait or baits are preferred.

Most commercially available mouse baits are ready for use and come in a variety of formulations. The most effective formulations are grain-based baits such as whole or rolled cereals, weather-proof block or extruded pellet. Grass seed, such as whole canary grass seed is highly accepted by mice. Mouse baits are generally formulated to have a reasonably long shelf life of up to two years.

Hoarding by mice varies from species to species and is believed to constitute only a small portion of “consumed” bait. Where excessive hoarding is suspect, use the same rodenticide but only in block form, and secure baits as indicated on the label. Bait blocks are also useful in high moisture environments such as silage pits or in some hog or poultry operations.

Warfarin mouse bait works well on mice, but because mice have a higher resistance to this anticoagulant, it is best to use Warfarin rodenticides that contain anti-bacterial agents such as sulpha quinoxaline.

Where anticoagulants have been used over long periods of time, there is an increased potential for bait resistance, and rodents are no longer affected by the poison. To date, bait resistance in mice does not appear to be present in western Canada.

Where bait has been set out and acceptance poor, the reason may be one or more of the following: too short a period of bait exposure, not enough bait set out, or the baiting area is too small.

With the exception of zinc phosphide, these baits are used in the same way as anticoagulant baits. Zinc phosphide differs from regular mouse baits because pre-baiting is recommended to increase bait acceptance.

### **Bait placement**

House mice are active in a small area and lack notable food preferences. Therefore, proper placement of baits or bait stations is often more important than the type of bait used. Mice will not visit bait stations or baited areas if the latter are not conveniently located in areas where mice are active.

For best baiting results, follow these recommendations:

- Place bait between the source of the mouse shelter and their food supply.
- Place bait or bait stations near burrows, against walls or along travel routes.
- Use traps or glueboards where bait is risky - such as near foodstuffs or where non-targets can find it.
- In hog or poultry barns attach bait boxes to wall ledges or the tops of dividing walls.
- Place bait where floors and walls meet, wherever possible.
- Where buildings are not rodent proof, place permanent bait stations inside buildings, along the outside of the building foundations, or around the perimeter.
- Do not place water bait above ground level and never use where other animals can find it.
- Wherever possible, cover bait or place in a bait station.

## Bait stations

Bait stations or bait boxes may increase the effectiveness and safety of mouse baits because they protect bait from dust and moisture, keep other animals away and provide cover for mice eating the bait. Also, they allow bait placement where it would be otherwise difficult to set out, and they allow for easy inspection of bait consumption.

Bait stations can contain solid baits (food baits), liquid baits or both. Bait stations can be made at home or purchased from commercial suppliers. Manufactured bait stations can be made of plastic, cardboard or metal and are generally available at farm, hardware and horticultural retailers.

Homemade stations can be built from scrap materials to fit individual needs. Make them out of sturdy materials, so they cannot be easily knocked out of place or damaged. Be careful to construct bait stations so that the bait is accessible to rodents only. Clearly label all bait stations and, especially, permanent stations with, "Poison Do Not Touch".

Build bait stations large enough to allow several rodents to feed at once. They can be as simple as a flat board or piece of sheeting nailed at an angle to the bottom of a wall, or a length of pipe into which bait can be placed. Use these bait stations in bins, barns or other buildings. In bale stacks, place a piece of sheeting or plywood over the bait, at an angle against a bale.

An empty, used tire with a small rock under it and a piece of plywood or sheeting on top with a heavy object such as a large rock, makes a convenient bait station (see figure 4).

Bait stations should have at least two openings at opposite ends, approximately 2.5 cm (1 in.) in diameter. Always keep fresh bait in bait stations, or remove them from use.

## Fumigants

Several fumigants are registered for mice and work well. However, commercial fumigant use is restricted to licensed pest control exterminators only. Other fumigants such as carbon monoxide (vehicle exhaust) or carbon dioxide can be effective if the treated area is completely sealed and the gas is exposed to mice for a long period of time.

## Trapping

Trapping can be very effective; however it is somewhat expensive and time consuming. Traps should be used where poisons are unsafe or in homes or garages where odour from poison-killed rodents can be a problem.

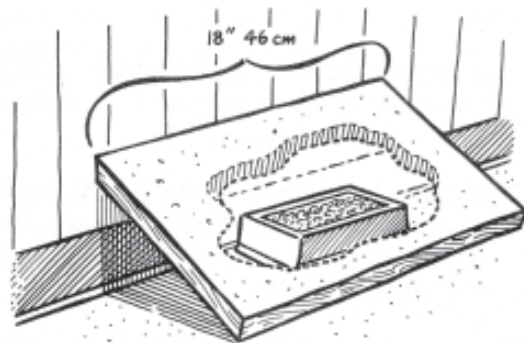
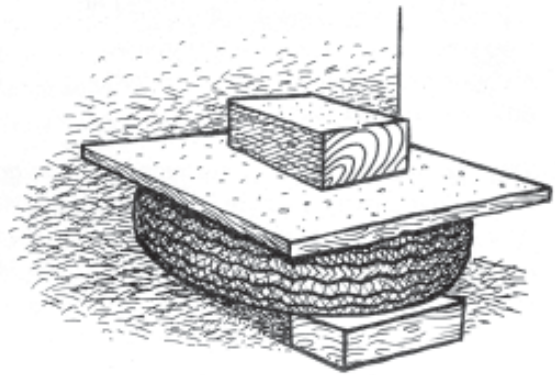


Figure 4. Homemade bait stations

The simple, inexpensive, wood-based snap trap can be found almost anywhere. Traps should be baited with a small piece of nutmeat, dried fruit, bacon or vanilla extract on a piece of cotton tied to the trigger. A small, unbaited, cotton ball works well because mice are constantly searching for nesting material.

The placement of traps is critical to their success. Set traps behind objects (where you see mouse droppings or tracks), in dark places and along the base of walls. Be sure to place traps in the correct direction so that the trigger end of the trap is closest to the wall (see figure 5).

Use enough traps to reduce mouse numbers quickly. Mice seldom venture far from their shelter and food supply, so set traps no more than 1.8 m (6 ft.) apart where mice are active.

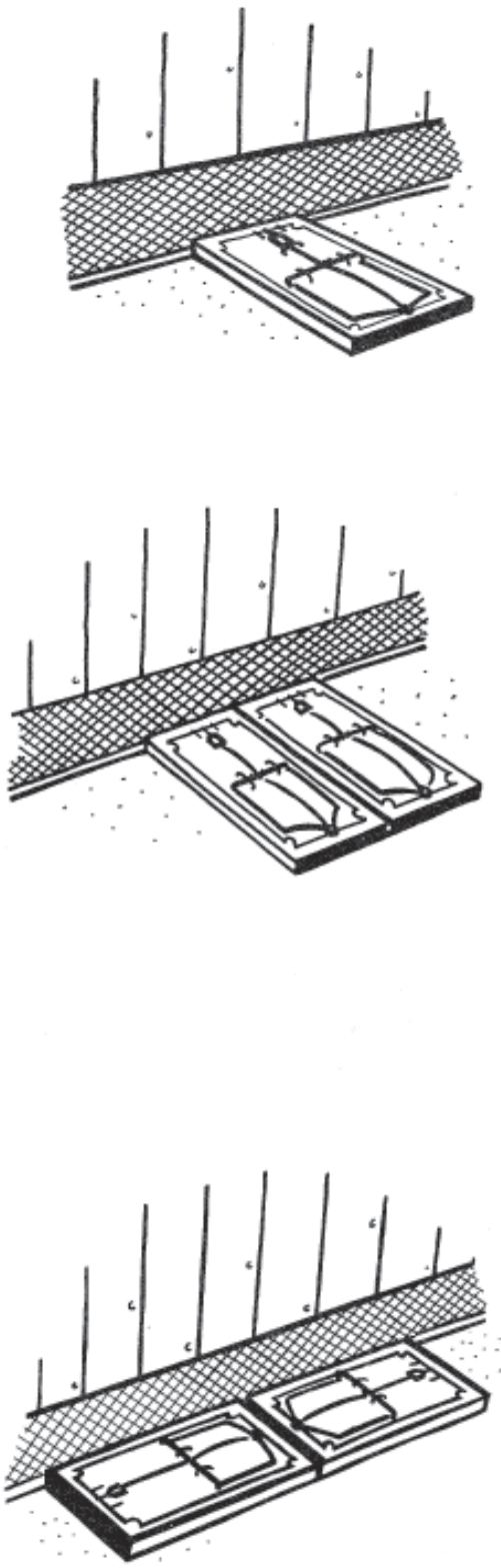


Figure 5. Placement of snap traps

Multi-catch (automatic) mouse traps work on the principle that mice enter a small capture hole in the trap. When triggered, the device entraps the animal in a holding compartment. Some multi-catch traps can capture over a dozen mice in a single setting. For this reason, these traps should be checked periodically so that mice do not die from starvation or exposure in the traps.

### Glueboards

An alternative to traps are glueboards, which catch and hold mice attempting to cross them, much the same way flypaper catches flies. Place glueboards wherever mice are travelling or where you would set traps. Do not use glueboards where children, pets or other non-targets can come into contact with them.

It is a good idea to cover glueboards to protect them from dust, debris and moisture, and be aware that temperature extremes can affect their stickiness. Cover glueboards much the same way you would a bag of bait (see figure 4). Use a stick to kill captured mice with sharp blows to the base of the skull.

### Other methods

Some cats and dogs will catch and kill mice around the home. There are few situations where they will do so sufficiently to control rodent populations. Farm cats, if sufficient in number and supplementally fed, may keep mouse numbers down to prevent reinfestations once mice have been controlled.

In urban areas, it is common to find rodents living in close association with cats and dogs, relying on cat and dog food for nourishment. Mice frequently live beneath doghouses and soon learn they can feed on the dog's food when the dogs are asleep, or absent.

Several natural predators such as hawks, owls, snakes and weasels may kill many mice. However, they do not control mouse populations; they merely remove the surplus.