

## Control of Pocket Gophers and Ground Squirrels

### Pocket gophers

Pocket gophers (Figure 1), commonly called moles, are a problem in pastures and hayland throughout much of Alberta. They also eat garden crops and kill woody plants and shrubs by feeding on the roots.

Pocket gophers tend to feed above ground in late spring and early summer, when stems and leaves are most nutritious. As the nutritional quality of stems and leaves declines, pocket gophers turn to feeding below ground on roots and other plant parts. These gophers create extensive burrow systems in search of food.

Soil from the burrows is deposited in mounds above ground. Increased mounding by gophers coincides with the haying season. One animal may make up to 50 mounds per year through its burrowing activity.

The mounds cause wear on farm machinery and necessitate slower operating speeds. Mounds also smother desirable vegetation, provide a seedbed for annual weeds and reduce stand density, particularly in legumes.



Figure 1. Pocket gopher

### Biology

Unlike ground squirrels that hibernate, pocket gophers are active throughout the winter, feeding and burrowing beneath the snow.

Females have one litter of four to six young during late May or June. The young mature quickly and move out into surrounding areas during late summer and fall. They tend to be solitary with one occupant per burrow system, except during the breeding season and when females are raising young. However, gophers seem to know when their neighbors disappear. Empty burrows may be re-occupied within two to three days.

### Control

Problems with pocket gophers are often made worse because many farmers do not try to control them until gopher populations are very high and damage is severe. In addition, gophers on roadsides, headlands and other uncultivated areas are frequently ignored even though these areas serve as reservoirs for gophers, which re-infest newly-seeded legume fields.

The best time to start pocket gopher control on legume fields and pastures is two to three years before seeding, when fields are in cereals or other annual crops and when gopher populations are low. This approach requires long-term planning with the objective of removing all gophers that might re-infest newly-seeded legume fields.

Crops should be rotated so that legumes are not seeded immediately adjacent to pastures and hayfields that are already infested with gophers. Control must be started when gopher populations are at their lowest level, and gopher numbers must be maintained at near zero. In other words, one gopher is too many.

### *Herbicides*

Pocket gophers are forb or broadleaf eaters (for example, dandelions and alfalfa are broadleaf plants); the gophers cannot obtain enough energy to raise young on a diet composed strictly of grasses. Thus, pocket gopher numbers can be considerably reduced from roadsides, headlands and other uncultivated areas with a herbicide that eliminates broadleaf plants (2,4-D for example). Similarly, gophers can be eliminated from cereals and other annual crops by cultivation and effective weed control.

Headlands and roadsides should be treated with a herbicide when adjacent fields are in annual crops, preferably cereals, two to three years before legumes are seeded. If legumes are adjacent to headlands and roadsides, then gophers can obtain an adequate diet by moving into the legumes. Consequently, the herbicide treatment will be less effective. An effective herbicide treatment in early spring should reduce gopher populations by 85 to 90 per cent by the following year.

The remaining gophers should be removed with traps or poison, and infested areas should be spot-treated with herbicide. Brushy or wooded areas need not be treated with herbicide because these are not prime gopher habitat. The few individuals that live within or along the edges of brushy or wooded areas can best be controlled using traps.

Removing all gophers from headlands and uncultivated areas will not totally eliminate gophers from newly-established legume fields because some do move overland. However, most gophers either move in from the headlands or are raised within the field. Removal of all gophers from annual crops, headlands and other uncultivated areas should lead to manageable gopher control or at least delay serious damage on haylands by one or two years.

### *Toxicants*

Strychnine alkaloid and zinc phosphide are registered for pocket gopher control in Alberta. Strychnine is probably more effective than zinc phosphide. Toxicants are usually applied to grain baits, which become less effective after vegetation becomes green in the spring.

Timing is most important; control should be conducted as early as possible in the spring after snow melt and before vegetation begins to grow. Further, it must be emphasized that effective control will probably be achieved only when populations are low, before serious damage occurs.

Underground baiting of pocket gophers is of minimal hazard to other wildlife that might consume bait or eat poisoned gophers. However, poisoned bait spilled on the ground is a hazard to other animals, particularly ground-feeding birds.

### *Hand baiting*

Regardless of the method used, bait must be placed within the burrow system. The key to baiting by hand is locating the burrow system.

Gophers tend to throw soil downhill, so the burrow will be located up slope from the mound. Gophers also throw soil away from the burrow entrance creating a fan-shaped or horseshoe-shaped mound. After the mound is built, the gopher plugs the burrow entrance with several centimetres of soil, so the entrance may not be conspicuous. However, the burrow will be located up slope from the mound and at the base of fan-shaped mounds or in the indentation of horseshoe-shaped mounds. The burrow will be 2 to 20 cm below ground level and can be located with a probe.

A long screwdriver or a 1 cm-diameter rod sharpened at one end will make a satisfactory probe. For best results, begin to probe 1 to 2 cm from the edge of the mound. You will know you have located the burrow by the decreased friction on the probe.

Open the burrow system with a shovel and place a tablespoon of bait in each direction in the burrow. Bait should be placed well into the burrow, and the opening should be blocked with soil. If the burrow is left open, the gopher will plug the burrow with soil and may cover the bait before it is eaten.

As an alternative to the method just described, an opening can be made with a probe from the surface of the ground to the burrow. A tablespoon of bait should be dropped into each of two or three probe openings. The openings should then be plugged with soil.

Hand-operated bait-dispensing probes are commercially available although they seem to be unduly heavy. Dispensing bait through a hole made with a probe is faster than opening burrows with a shovel, but you cannot be certain the bait is always placed in a burrow actively being used by gophers.

### *Mechanical burrow builder*

In the late 1950s, a burrow builder was developed to mechanically deliver bait underground so that large areas could be treated for pocket gopher control. The burrow builder is tractor drawn and looks vaguely like a plow. The device consists of a knife and torpedo assembly that makes an artificial burrow at desired soil depths, a coulter that cuts the soil ahead of the knife and a seeder assembly for bait dispensing.

The burrow builder has been used throughout Alberta with mixed results. It does not work well in soil that is sandy, rocky, dry or shallow. However, some farmers have used the burrow builder very effectively. Contact your local municipal agricultural fieldman to determine if the burrow builder has been effectively used in your area.

### *Trapping*

Gophers can be controlled by trapping, although the method is somewhat time consuming. Probably the best trap on the market today is the box-type gopher trap. These traps are set by removing the fresh mound and placing the trap in the entrance of the lateral tunnel. As many as 20 to 40 traps may be required to remove gophers from fields larger than 16 ha (40 acres).

Traps are most effective in early spring when gopher populations are at their lowest level and mounds are more conspicuous. However, traps can be used in late summer and fall, after forage has been removed and the gophers are building mounds. Traps are set in the burrows. A method for locating gopher burrows was described in the hand baiting section.

### *Pocket gophers and grazing intensity*

Pocket gopher numbers have been shown to increase as grazing intensity increases on native fescue grassland in southern Alberta. Changes in gopher numbers seem to be associated with changes in the physical characteristics of the soil. This means that prolonged overgrazing may cause changes in soil condition that may favor high gopher populations for many years after overgrazing ceases.

## **Richardson's ground squirrels**

Richardson's ground squirrel (Figure 2), commonly called the gopher, prairie gopher, yellow gopher, flickertail, or picket pin, occurs on rangeland, pastures and cropland throughout Alberta, with the exception of the Peace River region.

Ground squirrels eat a wide variety of grasses and broadleaf plants and may compete with livestock for forage. Damage to cereals can be particularly severe on the edges of fields adjacent to native grassland. In addition, mounds of soil excavated from burrows smother desired vegetation and can damage farm machinery.

Ground squirrels are also an important food item of badgers, which, in turn, can cause damage to crops and pastures through their burrowing activity. Ground squirrel damage on cropland may increase as no-till or minimum tillage becomes more common.



*Figure 2. Richardson's ground squirrel*

### **Biology**

Adult male ground squirrels emerge from hibernation in early spring, often while the ground is snow covered. Adult females emerge about 10 to 14 days later than the males.

The mortality of males is high in the spring as many die from predation, starvation, inclement weather and drowning. Many others are forced into unfavorable habitats by competing males. Food is scarce and cannibalism is common until the vegetation starts to turn green. Consequently, while there may be one male for every two females at emergence, only one male for every eight or ten females may remain by mid-May.

Females breed one or two days after emergence from hibernation and give birth about 24 days later in April or early May. Females seem to be relatively inactive for four or five days after giving birth.

Only one litter is born per year. Litter size varies with the quality of vegetation, averaging five or six on native pasture, while nine or ten young per litter are common on or adjacent to alfalfa and clover fields.

The young appear above ground 25 to 30 days after birth. However, as many as 50 to 80 per cent of the young may die in the nest from starvation or other related causes, depending on the quality of vegetation eaten by the nursing female. A large percentage of the young ground squirrels move to a new area and establish a new burrow system during June and July. Movements of 3 km are common.

Ground squirrels live on fat reserves during hibernation. They will enter hibernation as soon as they have enough fat reserves to carry them through winter. Adult males enter hibernation in late June or early July while adult females do so later on in July and the young hibernate in mid-August to as late as September. Most of the squirrels still active in September are young males and only a few will live through the winter.

## Control

### *Toxic grain bait*

Control with poisoned oats, wheat or barley is the most practical method for removing ground squirrels from large areas. Strychnine alkaloid and zinc phosphide are registered for ground squirrel control on cropland, pastures and rangeland in Alberta. Poisoned grain baits must be placed within the burrow entrance or in a safe and secure bait station.

Directions on the label should be strictly followed. About one tablespoon of bait should be placed in each burrow. Each burrow will usually have several entrances, so not every hole needs to be baited. Baited entrances need not be closer than 8 to 10 m apart.

The anticoagulant toxicants, chlorophacinone and diphacinone, are also registered for ground squirrel control on cropland, rangeland and pastures. Anticoagulants interfere with the clotting mechanism of the blood and cause a painless death from internal bleeding three to four or more days after bait is eaten. The anticoagulants mentioned above may also be used under certain conditions for ground squirrel control in cities, towns and residential areas. Label instructions should be strictly followed at all times.

Both anticoagulants are available as commercially-prepared baits; chlorophacinone is available in a liquid concentrate that can be mixed with grain.

For these toxicants to be effective, ground squirrels must feed on chlorophacinone or diphacinone on two or more successive days. Thus, the baiting strategy differs from the use of fast-acting toxicants. For hand baiting, six pellets or tablets, or about 5 mL (1 teaspoon), of bait should be placed within the burrow entrance. After 48 hours, the site must be revisited, and all holes should be re-baited where the bait has been removed or consumed. A third visit may be necessary for complete control.

As an alternative to hand baiting, the anticoagulant baits may be placed in protected bait stations spaced every 30 to 60 m in the infested area. Each station should contain about 500 g (1 pound) of bait. Bait stations should be checked daily to maintain an uninterrupted supply of bait for three weeks or until feeding ceases.

Bait stations can be made from 20-litre cans with two or three entrances for ground squirrels made by cutting 8 to 10 cm (3-4 inch) holes on the side of the can near the bottom. Bait stations can also be made from old tires with two or three entrances for squirrels cut in the face of the tire. Bait stations should be secured to the ground and covered so that they cannot be upset by domestic animals, particularly dogs. Many dogs like the commercially-prepared bait and will consume a lethal dose if allowed to do so.

### *What bait and method should be used?*

Bait and method will be determined by the following considerations:

- human safety
- hazards to livestock, pets and non-target wildlife
- cost
- effectiveness of control

All toxicants are potentially dangerous and should be handled with the utmost care to avoid accidental poisoning. However, anticoagulants are generally less hazardous to people than strychnine or zinc phosphide.

Most mammals and birds have a low tolerance for strychnine and zinc phosphide; small quantities can kill humans and large animals. Further, they are fast acting; the time from ingestion to sickness to death can be only minutes. Thus, speed is of the essence in the administration of first aid and treatment by a physician.

By contrast, rodents are much more susceptible to anticoagulant poisoning than humans and other animals. With anticoagulants, the time from ingestion to death is usually three or more days, which would allow a person to be treated by a physician and a domestic animal to be treated by a veterinarian.

Hazards to livestock, pets and wildlife depend primarily on the baiting technique. Poisoning can occur by eating the bait or eating animals that have been poisoned. Placing bait within the burrow will reduce the chances that animals other than ground squirrels will eat the bait. Birds are supposedly less inclined to eat grain that has been dyed a bright red or green. As noted above, bait stations should be secured so that they cannot be tipped over or broken into by livestock, pets and wildlife.

Animals can be poisoned by eating ground squirrels that have consumed strychnine or anticoagulant baits. Therefore, ground squirrels that die above ground should be picked up and buried. Zinc phosphide rapidly changes to phosphine gas in the intestinal tract of ground squirrels. The gas quickly dissipates, so the chances of secondary poisoning from zinc phosphide are relatively low.

Commercially-prepared baits are usually more expensive than those mixed by the user. Baiting individual burrows is usually more effective than using bait stations but also requires more time. Burrows must be re-baited at least once if anticoagulants are used, and consequently, labor costs increase.

## **For effective ground squirrel control**

### ***Be sure the entire ground squirrel population is active***

Timing is the key for long-term ground squirrel population reduction with lethal methods. The best time to bait ground squirrels is just before vegetation begins to turn green in the spring when ground squirrels are frequently undernourished. Do not bait at the first sign of activity in the spring because adult males emerge from hibernation 10 to 14 or more days before the adult females.

Ideally, you should shoot 10 or more ground squirrels in the control area and determine their sex before baiting with toxicants; the area, should not be baited until 50 to 75 per cent of the ground squirrels are females.

Baiting of ground squirrels will probably be less effective during late spring and summer. They do not readily accept grain after green vegetation is available, and many adults will be in hibernation by mid-July. There is a period of bait acceptance in late June before ground squirrel hibernation, just when the green grass is turning brown, especially in a dry spring, that ground squirrels will eat cereals. Long-term ground squirrel control is not achieved, but short term relief from high numbers of the current year's squirrels may result.

### ***Be sure ground squirrels are readily accepting grain***

Before baiting with toxicants, offer untreated grain at several active burrows. If the untreated grain is not eaten, toxic grain will not be eaten either. As a further test, place a teaspoon of wheat, oats and barley on each of several mounds to determine which grain is preferred by ground squirrels in your area.

### ***Use fresh bait***

Bait that is more than a few months old should not be used. The toxicity of the bait does not diminish, but its acceptability by ground squirrels does.

### ***Strychnine and zinc phosphide baits should be used only once per year in a given area***

If the first attempt at control was not successful, re-baiting the same year will probably not be effective either. Many of the ground squirrels that survived the original baiting operation probably ate some of the poisoned bait and became ill, and consequently will be "bait shy" the second time. Thus, it is important to do a good job the first time bait is applied.

If the first baiting is ineffective and a second baiting is necessary, then the type of grain and toxicant should be changed. For example, you should change from strychnine on oats to zinc phosphide on barley. Pre-baiting (explained below) may also be necessary.

Ground squirrels should not become bait shy from anticoagulant baits because the time between ingestion of a bait and sickness is several days. Consequently, ground squirrels will not associate the sickness with the anticoagulant bait.

### ***Pre-baiting may increase acceptance of strychnine and zinc phosphide treated bait***

Pre-baiting means exposing untreated grain to ground squirrels for several days before using poisoned grain. This approach accustoms ground squirrels to the new food and improves the chances of their eating a lethal dose of toxic grain before they become ill and cease feeding.

Pre-baiting often improves bait acceptance and control. However, it does increase the cost of control. Pre-baiting is usually not possible with commercially-prepared baits because they contain a mixture of grains and other ingredients, and the recipe is not available to the customer. Pre-baiting is not necessary if anticoagulant toxicants are used.

## **Other methods of control**

Ground squirrels can be controlled by shooting, trapping or gassing, but these methods are time consuming and usually effective only in small areas. A gassing technique using liquid foam forced down the burrow under pressure, which actually drowns the ground squirrel, works quite well in small areas of squirrel infestation where other techniques are difficult to use. The product is called EXIT and is available through commercial applicators.

The poison aluminum phosphide "Phostoxin" is a new gassing control method just recently registered and has shown some good control results. Applicators must have an exterior rodent control licence to apply the product, and caution must be exercised to ensure safety as the gas is toxic to all life forms. One to two pellets are placed in each active burrow, and the entrance filled in with dirt. All label restrictions must be followed closely. Baiting should be done when the ground squirrels are underground for the day, which usually means baiting late in the day after Richardson ground squirrel activity has ceased.

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