

## Control of Richardson's Ground Squirrel

### Background

Richardson's ground squirrel (RGS) range covers much of the North American Great Plains and includes portions of Alberta, Saskatchewan, Manitoba, Montana, North Dakota, South Dakota and Minnesota.

These pests are herbivores. They eat forage grasses, forage legumes, cereal crops, pulse crops, canola and native grasses. When they occur in great numbers, agricultural producers can accrue significant financial losses.

Each adult RGS maintains a home range and allows only its closest kin to intrude. They prefer open terrain with good visibility to detect approaching predators. They fare well in human modified habitats such as city parks, over-grazed pastures, chem-fallow fields, the edges of cultivated fields and perennial forage stands. A female ground squirrel's home range during summer months averages about 240 square metres, and its borders will often overlap with those of its neighbours. Each adult female owns at least one burrow system that has two or three exits and two to five sleeping chambers.

The range includes the main burrow system as well as favourite feeding sites. The range of an individual ground squirrel is not static and changes throughout the year in response to various factors including the mating season, population density, presence of juveniles, availability of feed and the onset of hibernation.

RGS can be seen above ground from mid-February to October. Adult males will emerge from the ground in February followed by the females in March. Both sexes are reproductively mature at one-year old. Mating occurs shortly after the females emerge from hibernation in March. Each female produces one litter of six to eight pups per year. Juvenile squirrels first emerge above the ground when they are about four weeks old. Generally, 10 to 20 per cent of juvenile males and 40 to 50 per cent of juvenile females survive to adulthood. The maximum life span is three years for the male RGS and six years for females.



*Raptor platform*

### Control Measures

Historically, control measures for RGS have included trapping, shooting and a variety of toxic baits such as arsenic, scilloricide, thallium and strychnine. However, continued efforts are being made to develop improved integrated pest management practices that incorporate a variety of strategies to reduce the reliance on traditional rodenticides. The objective is to develop a long-term, sustainable management system that includes rodenticides but also utilizes non-chemical means to keep infestations below economic threshold levels. The economic threshold is the level at which the pest damage exceeds the cost of the management options.

For example, habitat modification can reduce RGS preference for an area and improves predator success.

Raptor platforms and nest boxes can be used near RGS colonies to increase predation, especially in areas such as Southwest Saskatchewan where suitable nesting sites may be limited in the vicinity of ground squirrel infestations.

Studies have shown that grazing practices that favour taller grass stands may reduce the number of RGS because of their preference for short grasses. Whenever possible maintain vegetation on pastures or forage at a height greater than 15 cm.

Monitoring population levels and proactively managing pest numbers on an annual basis can prevent the build-up of RGS populations and avoid economic losses associated with high population levels.

## Winter 2023-2024 Burrowing Rodents Survey

The ministry conducted an online survey in December 2023 and January 2024 to assess distribution and severity of damage caused by burrowing rodents including Richardson's ground squirrel, Franklin's ground squirrel, thirteen-line ground squirrel, and northern pocket gopher. Respondents were also asked about the use and satisfaction with specific control methods. Please see [the report and maps of RGS damage](#).

## Chemical Control of Richardson's Ground Squirrel Populations

Currently, rodenticides are the most effective method of managing RGS damage over large agricultural areas. Grain-based poison baits have been the preferred method of control for years. These products are relatively inexpensive, readily accessible and easy to use. However, RGS management is labour-intensive regardless of the control method used.

Early spring is the best time for control because RGS emerge from their winter burrows in search of food. Males emerge first and are generally robust and well-fed from below-ground food caches. When females emerge, they tend to be hungrier and will more readily consume the easily acquired toxic baits. Controlling reproductively mature females will have a greater effect in reducing populations. The efficacy of grain baits, regardless of the active ingredient, can be greatly reduced after green growth appears in the spring and ground squirrels have more feeding choices.

The chart below indicates typical periods of activity for ground squirrels.

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	<b>Emerge above ground</b>	<b>Enter hibernation</b>
Adult males	mid-February to early March	mid-June to early July
Adult females	early to mid-March	early to late July
Juvenile females	early to mid-May	early to mid-August
Juvenile males	early to mid-May	mid-September to October

# Strychnine

The Pest Management Regulatory Agency of Health Canada issued a decision to de-register Strychnine for Richardson's ground squirrel control March 4, 2021. Sale was permitted until March 4, 2022 and use can continue until March, 2023. Use after this time is not permitted. Strychnine is a highly toxic compound. There is no antidote.

## Strychnine Alternatives

Several products are registered for the control of Richardson's ground squirrel and other burrowing rodents (Table 1). In spring 2022 and 2023, the Ministry of Agriculture conducted an evaluation of the efficacy of strychnine and some registered alternatives for RGS control (Tables 1 and 2).

**Table 1: Other toxic baits and rodenticides registered for RGS control**

Active Ingredient	Product Name	Per cent Active Ingredient
Zinc Phosphide	Burrow Oat Bait (PCP# 24795)	2.0%
	ZP Rodent Bait (PCP# 14240)	2.0%
	Rodent Bait (PCP# 16122)	2.0%
	Rodent Pellets (PCP# 21838)	2.0%
	ZP Rodent Oat Bait (PCP # 29030)	2.0%
Chlorophacinone	Rozol Paraffinized Pellets (PCP# 13729)	0.005%
	Ground Force Paraffinized Pellets (PCP# 20239)	0.005%
	Poulin's Gopher Doom (PCP# 22608)	0.005%
Diphacinone	Rozol RTU Field Rodent Bait (PCP# 29545)	0.005%
	Ramik Green Rodenticide (PCP# 11669)	0.005%
Aluminum Phosphide	Degesch Phostoxin Round Tablets Rodenticide (PCP# 16351) (Fumigant)	55%
	Gastoxin Aluminum phosphide tablets (PCP# 17187)	57%
	Gastoxin Aluminum phosphide pellets (PCP# 17188)	57%
	Gastoxin Aluminum phosphide tablets (PCP# 23842)	57%
	Gastoxin Aluminum phosphide sachets (PCP# 23843)	57%
	Weevil-Cide Tablets (PCP# 29455)	57%
	Weevil-Cide Tablets (PCP# 30013)	57%

White Mustard seed powder (a) and Sodium Alpha-olefin sulfonate (b)

RoCon™ Concentrate Rodenticide (PCP# 27400)

(a) 10.89% (b) 6.91%

**Table 2: Strychnine and alternatives tested spring 2022**

Product	Registration number	Active ingredient	Toxicant effect	Formulation	Notable considerations
2% Liquid Strychnine Concentrate	30433	Strychnine	Respiratory failure	Liquid concentrate. Requires mixing with grain bait to achieve 0.4% application concentration	Deregistration decision March 2021. Last permitted use March 2023
Burrow Oat Bait	24795	Zinc phosphide	Central nervous system depressant	Coated oats	Pre-baiting for best results. Not required
ZP Rodent Oat Bait AG	29030	Zinc phosphide	Central nervous system depressant	Coated oats	Pre-baiting for best results. Not required
Rozol RTU Field Rodent Bait	29545	Chlorophacinone	Anticoagulant	Pellet	Re-baiting required after 48 hours. Third baiting may be required
Ramik Green	11669	Diphacinone	Anticoagulant	Pellet	Re-baiting required after 48 hours.

**Table 3: Costs per acre of strychnine and alternatives tested in 2023**

Product	\$ per acre at high label rate
2% Liquid Strychnine Concentrate	13.28
Burrow Oat Bait	8.46
ZP Rodent Oat Bait AG	6.74
Rozol RTU Field Rodent Bait	21.86
Ramik Green	12.34

Results of this work indicated that the zinc phosphide products, ZP Rodent Oat Bait and Burrow oat bait were as effective as strychnine and less expensive (Table 3). They also present a reduced risk of secondary poisoning and are not environmentally persistent.

### Strychnine Alternatives Summary

Concerns have been raised about the deregistration of an effective control product, two per cent liquid strychnine, mixed with grains to make a toxic bait. However, there are registered alternatives for RGS control including some ready to use products. The second year of strychnine alternatives evaluations was conducted in 2023 by South of the Divide Conservation Action Program Inc. (SODCAP), funded under the Sustainable Canadian Agricultural Partnership Strategic Field Program, and by collaborators with

Alberta Agriculture and Forestry and the Municipal District of Willow Creek in Alberta. Both groups followed the same protocol used in 2022. We again compared the efficacies and non-target effects of strychnine baits to the alternatives: Zinc Phosphide products, Burrow Oat Bait and ZP Rodent Oat Bait AG and the anticoagulant baits, Rozol RTU (chlorophacinone) and Ramik Green (Diphacinone). Like the results of 2022, all of the alternative products tested in 2023 provided significant reductions to RGS local populations. Non-target effects were limited to a thirteen-lined ground squirrel and two deer mice in Saskatchewan. Burrow Oat Bait and ZP Rodent Oat Bait AG continued to be less expensive than strychnine applications at the high application rate for each (\$8.46 and \$6.75 per acre, respectively, compared to \$13.28 per acre for strychnine). Both Rozol RTU and Ramik Green require multiple applications and are more expensive (\$21.86 and \$12.34 per acre per application, respectively). Because of costs, and more rapid kill and lower probability of residues in sick and dead target animals, we recommend use of the zinc phosphide products.

## Zinc Phosphide

Zinc phosphide is a crystalline, dark powder with a garlic-like odour. It has been around a very long time as a rodenticide. It was first synthesized in the mid-1700s and used as a rodenticide in Italy around 1911–12. It breaks down to produce phosphine when it encounters stomach acid. It works quickly with onset of symptoms of lethal poisoning apparent within 15 minutes. Death usually occurs in hours. Zinc phosphide continues to break down in rodents that have been killed and risks to non-target animals and birds associated with residues are considered to be relatively low.

### Precautions

Follow all product label directions and precautions.

Prevent children, pets and livestock from gaining access directly to any toxic baits.

Burrow Oat Bait - This can be fatal if swallowed. Wash hands and any skin that could have made contact with the bait thoroughly with soap and water after handling. Wash contaminated clothing separately from other laundry, with soap and hot water before reuse. Users should remove clothing immediately if pesticide gets inside, then wash skin thoroughly and put on clean clothing. Chemical-resistant gloves must be worn when disposing of dead rodents, unconsumed bait and empty containers. Avoid contact with skin, do not breathe in dust or fumes, do not leave in unprotected piles and avoid feed and other foodstuffs to prevent contamination.

## Anticoagulants

Anticoagulants are separated into two functional groups: first-generation and second-generation. First-generation anticoagulants are used for the control of certain field rodents, including RGS, pocket gophers, and voles. Second-generation anticoagulants have the ability to control warfarin-resistant rats and house mice and are also considered single use feeding anticoagulants.

First generation anticoagulants (diphacinone and chlorophacinone) used for the control of RGS are multiple-dose rodenticides. These products rely on a cumulative toxic effect. They are substantially more toxic if consumed in small doses over a period of several days than if ingested in a single dose. The baits are formulated so that rodents have to feed a minimum of three to five days before a lethal dose is attained. Death takes a few days later. In order for the animal to consume a sufficient amount of poison, the bait must be made available on a continuous basis until the desired control is achieved.

Bait stations or bait boxes have to be designed to hold substantial amounts of bait (500 g or one lb.), and must be strategically located so that targeted rodents have access to ample bait for repeated feedings. Bait stations should be designed to prevent access and exposure to non-target animals and be secured to prevent tampering.

The delay in mortality has a safety advantage because it provides time to administer an antidote if necessary to treat pets, livestock and people who may have accidentally ingested the bait. Vitamin K1 is the antidote for anticoagulants. If administered soon after

intake, can reverse the action of the anticoagulant. In addition, the slow action of the anticoagulant baits has another advantage in that the target animal is unable to associate its illness with the bait consumed. Therefore, bait shyness or toxicant shyness does not occur. However, since legumes are a natural source of vitamin K, reduced efficacy can occur if RGS have access to alfalfa or other legume crops.

Most of the anticoagulant baits used currently are commercial ready-to-use formulations. While ready-to-use baits may increase the cost of rodent control, they avoid problems of incorrect bait concentrations and poor bait formulation, which often lead to poor control.

These have been the most commonly used rodenticides worldwide for over 50–60 years. All anticoagulants have two actions: they reduce the clotting ability of the blood and cause damage to capillaries (tiny blood vessels). The rate of blood clotting gradually decreases and blood loss leads to an apparently painless death. Repeated daily doses of anticoagulants greatly increase efficacy. Feeding does not have to be on consecutive days, but several feedings should occur within a 10-day interval with no longer than 48 hours between feedings. Ample bait must be made available at all times to achieve adequate control.

## Precautions

Follow all product label directions and precautions.

The bait should be placed in areas inaccessible to non-target animals or in tamper-resistant bait stations. If a pet such as a cat or dog ingests single substantial ingestion amount of diphacinone or chlorophacinone it will require veterinary attention. However, when used according to label instructions, the risk to non-target species is greatly reduced. Predators or scavengers consuming moribund rodents and carcasses are also a concern when anticoagulants are used for field rodent control.

**For immediate assessment and treatment recommendations for poison and chemical emergencies, call:**

Saskatchewan Poison Centre

Toll Free: 1-866-454-1212

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## Related Items

### [Strychnine De-registration and Disposal](#)

Learn why strychnine is no longer permitted for control of Richardson's ground squirrels in Canada and how it should be disposed of.

 [PDF](#)

## Contact the Agriculture Knowledge Centre

**Toll Free Number: 1-866-457-2377**

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