



Controlling Piute Ground Squirrels in Southwest Utah

Mark Nelson, USU Extension Agent, Beaver County
Nicki Frey, USU Extension Wildlife Specialist

Ground squirrels are troublesome rodent pests for farmers and homeowners. The Piute ground squirrel, *Spermophilus mollis*, is commonly found in the Great Basin of Utah and Nevada. The species is quite common throughout its range in western Utah along the Nevada border, but has also been found in central Utah. It was formerly considered a sub-species of Townsend's ground squirrels, but have now been recognized as a separate species.

The Piute ground squirrel eats grasses, seeds, alfalfa, other agronomic crops, and sometimes meat. The species mates in late winter or early spring, and females produce a litter of five to ten young about 24 days after mating. Because of its affinity for crops, the Piute ground squirrel can cause a great deal of agricultural damage in areas with large populations.



Piute ground squirrel eating alfalfa.

Identification

It is easy to identify Piute ground squirrels since they forage above ground near their burrows. Adult Piute ground squirrels may be up to 7 inches long with a short bi-colored tail about 2 inches in length. The belly and flanks are mostly white. The best way to distinguish them from other ground squirrels is by the pale brownish-gray color, absence of stripes, and inconspicuous tail and ears.

Biology and Behavior

Piute ground squirrels live in colonies and construct underground burrows that have several entrances. The burrows may be up to 6 feet deep. The squirrels generally enter their burrows to estivate, a period of sleep where animals go dormant to escape summer heat. Additionally, they hibernate during the coldest part of the winter. Males usually become active above ground 1 to 2 weeks before the females in the spring, sometimes as early as the first of February. A few may be active above ground throughout the year. Breeding occurs immediately after hibernation. The young are born after a

24-day gestation period with 5 to 10 young per litter. Generally, only one litter is produced each year. Densities of the ground squirrel populations can range from 5 to 50 or more per acre.

Ground squirrels are primarily herbivorous, and their diet changes with the season. After emerging from hibernation, they feed almost exclusively on green grasses and herbaceous plants. When annual plants begin to dry and produce seed, squirrels switch to seeds, grains, and nuts, and begin to store food. Ground squirrels usually forage close to their burrows. Their home range typically is within a 75-yard radius of their burrow.

Damage

Ground squirrels eat alfalfa, grasses and other agronomic crops. The reduction in alfalfa and other crop yields and the cost of controlling the squirrels exceeds hundreds of thousands of dollars annually. They also destroy golf courses, and lawns; and can be reservoirs for diseases such as plague. Their burrowing activities can weaken and collapse ditch banks and canals, undermine foundations, and alter irrigation systems. Burrow mounds not only cover and kill vegetation, but damage haying machinery. Piute ground squirrels in Utah are not a protected species. However, before initiating any lethal control measures consult with your USU County Extension Agent.



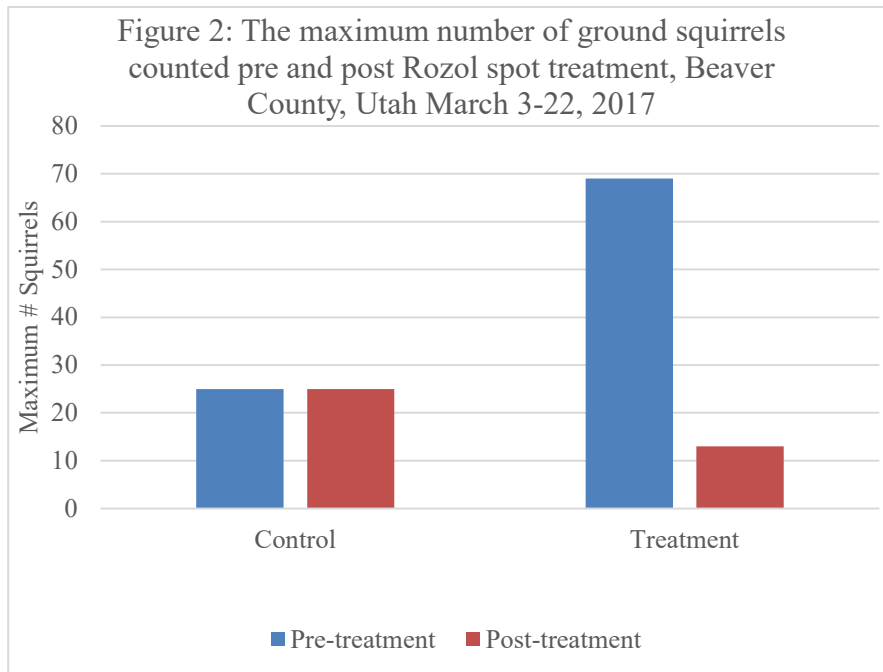
Damage caused by Piute ground squirrels in alfalfa field.

Extension Research

Squirrels are increasing in infested areas each year and are showing up in places not previously found. Previous control programs such as shooting, flooding, treating with zinc phosphide and gopher bait have not been effective. For the past 10 years Utah State University Extension has conducted several trials to determine which baits are most accepted and when is the best time to apply them. Extension has also conducted trials to compare different methods of fumigation.

Toxic Baits

Rodenticide-treated baits are the most economical of all approaches to population reduction and, hence, have traditionally been the mainstay of ground squirrel control. Diphacinone and other anticoagulant rodenticides are considered multiple feeding toxins, meaning that a ground squirrel must feed on the bait multiple times over several days to ingest a toxic dose. Anticoagulant rodenticides have low primary toxicity concerns (that is, mortality of non-target wildlife that directly consume the toxicant), partly because they require multiple feedings to acquire a toxic dose and because they can be applied in bait stations that are not generally accessible to non-target species. Toxic grain baits that are a restricted use pesticide, such as Rozol Vole Bait, can only be applied by licensed pest management professionals and are not available for use by residential users for ground squirrel management.



Research has shown that Piute ground squirrels are not attracted to whole grain baits. They prefer a small pelleted bait. Because of the research conducted, the State of Utah has issued a Section 24(c) Special Local Need Label for the Rozol Vole Bait (0.05% Diphacinone) for the control of the Piute ground squirrel. This label allows for bait station baiting and spot baiting. The research has shown up to 75% control when applied before the alfalfa greens up in the

spring. Once the alfalfa greens up, fumigation is more effective for control of the squirrels than baiting.

Toxic Bait Best Practices

Anticoagulant baits generally require 2 to 4 weeks or more to control populations. Continue baiting until all feeding ceases and you no longer see any squirrels. Although most animals will retreat below ground as they feel ill, a few ground squirrels will die above ground. Wearing gloves, you should pick up and dispose of those that do by placing them in a closed waste bin or burying the carcass underground. Also, be sure to pick up and dispose of unused bait upon completion of the management program, according to label instructions.



Producer applying bait using a 4-wheeler.

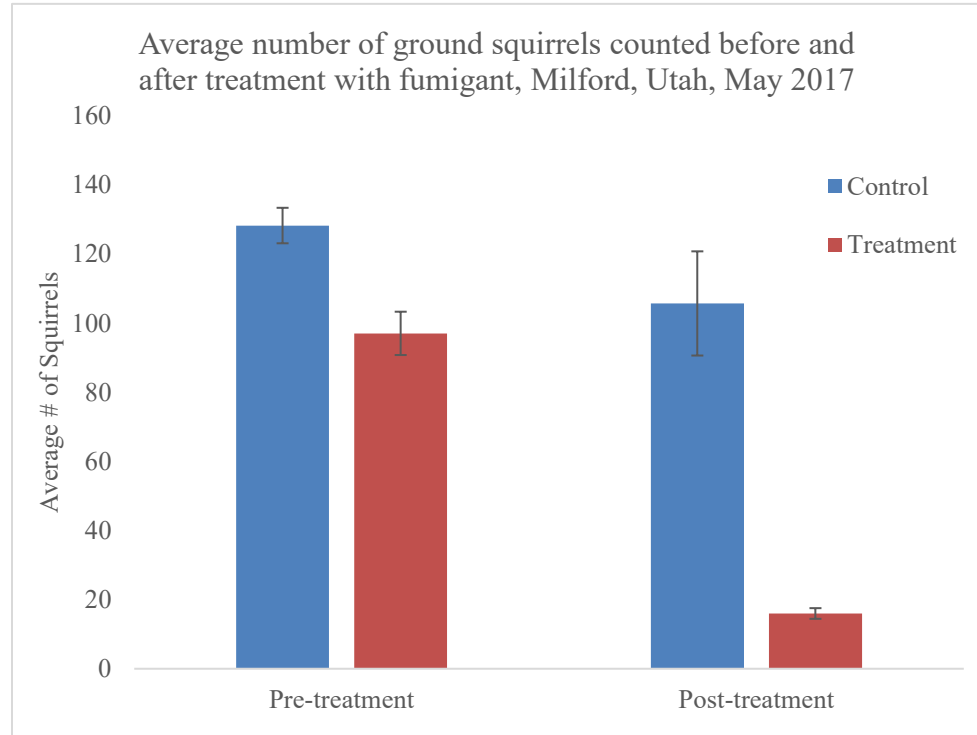
The timing of baiting programs is critical to good control. Baiting should not begin until the entire population is active. This usually occurs 2 to 3 weeks after the first adults appear. Baiting works best when it is applied before the alfalfa and other crops start to green up. Once green up begins, it is hard to get the squirrels to eat the bait. You should apply the bait next to the active burrows.

Bait placement is also very critical. Ground squirrels are accustomed to foraging above ground for their food and are suspicious of anything placed in their tunnel systems. Thus, baits should be scattered near each active burrow as specified on the label. All active burrows must be baited. Incomplete coverage of the colony will result in poor control success.

Fumigation

Fumigation is the practice of filling a ground squirrel tunnel system with poisonous gas, most often aluminum phosphide or gas cartridges. Burrow fumigation can be a safe method for managing ground squirrels. Burrow fumigation has a distinct advantage over toxicants and trapping in that it is linked to no behavioral change other than that squirrels seek the cover of their burrows when disturbed.

Fumigation is most effective following ground squirrel emergence from hibernation and before the squirrels have time to reproduce. Recently born squirrels, too young to venture above ground to be baited or trapped, are effectively controlled by fumigants.



As with any pesticide, read and follow label instructions, with regard for non-target species and safety factors. Fumigants have restrictions that require products to be applied only within burrows that are greater than a certain distance from structures that may be occupied. Read the product label to determine the application distance requirements pertaining to your site. We have examined several different methods of fumigation, described below.

Aluminum phosphide

Aluminum phosphide is a burrow fumigant that is very effective as a ground squirrel management tool. However, its use is restricted to licensed pest management professionals. Additionally, it cannot be used within 100 feet of any structure that is, or may potentially be, occupied by humans, pets, or livestock. This eliminates its use from most residential areas. Aluminum phosphide comes in tablet forms and reacts with the moisture in the soil to produce a lethal phosphine gas that is toxic to all mammals. Extension research has shown 97% control of ground squirrels by using the aluminum phosphide tablets. The disadvantage of using aluminum phosphide tablets is that if not used properly it can be lethal to humans, especially young children. The use of this product is strictly prohibited within 100 feet of any building. Aluminum phosphide is a Restricted Use Pesticide. Knowledge of its proper handling is required. In general, to use aluminum phosphide tablets, place the prescribed number of tables as far back into the burrow opening as possible. Then, insert a wad of crumpled newspaper into the burrow and seal it tightly with soil. The newspaper plug helps prevent the soil from covering the pellets or tablets,

permitting them to react more readily with the atmospheric and soil moisture. It is the reaction with moisture that produces the lethal phosphine gas.



Putting Aluminum Phosphide tablets in ground squirrel burrows.

Ignitable gas cartridges

Ignitable gas cartridges are also effective but are quite expensive and can cause a fire hazard in dry environments. Gas cartridges are lethal to any animal within the treated burrow; therefore, do not treat a burrow if you suspect a non-target animal is present. Fumigate only active ground squirrel burrows. Instructions for the use of gas cartridges are product-specific, so it is very important to consult the product label before use. Generally, to use a gas cartridge, puncture the cartridge cap and insert a fuse into the puncture hole. Place the cartridge into an active burrow entrance with the fuse pointing toward the interior of the burrow. Light the fuse and push the cartridge into the burrow with a shovel handle. Immediately seal and tightly pack the burrow opening with soil, but don't cover the cartridge itself with soil. Multiple entrances to the same burrow system do not necessarily need to be treated separately, but it is important to seal any additional openings. Use the smoke escaping from the burrow to

identify these entrances. Larger burrow systems, however, may require two or more cartridges. After 24 hours, check for reopened burrows, and re-treat as needed.

Carbon monoxide machines, (PERC)

Pressurized exhaust systems that inject concentrated carbon monoxide into burrow systems are also legal for use in Utah. Of these devices, the Pressurized Exhaust Rodent Controller (PERC) machine has been extensively tested and has proven to be effective for the management of ground squirrels. As with all burrow fumigation applications, these devices will be most effective under moist soil conditions. Carbon monoxide machines, (PERC) are effective in fumigating the burrows. The disadvantages of using the PERC machines are that they are expensive to buy, and it takes approximately 4-5 minutes to treat each hole. As with gas cartridges, one would use the smoke escaping from the burrow to identify unseen openings in the ground. These openings must be plugged or also treated.



Using PERC machine to fumigate squirrels.

Fumigation Best Practices

Fumigation is most effective in spring, or at other times when soil moisture is high, such as immediately after

irrigation. Moist soil helps contain the gas within the burrow system or may be required to properly activate certain fumigants (e.g., aluminum phosphide). Do not fumigate in summer or when the soil is dry, because the gas more readily diffuses into small cracks present in dry soil, making it less effective.

Do not fumigate during hibernation, because the ground squirrel plugs its burrow with soil, preventing fumes from reaching the nest chamber. You cannot see this plug by examining the burrow entrance.

Fumigants are dangerous to use in areas close to human population; when administered incorrectly, fumigants are highly toxic to anything in direct proximity to the gas. Do not attempt fumigation in populated areas.

To determine which ground squirrel holes are active, and thus should be targeted for fumigation, survey the area prior to administering the cartridges or tablets. Close any holes that you find by filling them with soil. After 48 hours, return to the site and locate any holes that have been opened or new holes that have been created. These are the locations you should target.

Other Management Techniques

Shooting. Shooting squirrels with small caliber rifles can provide some ground squirrel control, but it is very time consuming and expensive. To reduce the squirrel population, one must shoot >80% of the animals present. Additionally, squirrels will often come to recognize shooting and become gun shy. They may learn to retreat to their burrows any time a vehicle drives in to the area or they hear a gunshot.

Biological control. Many predators, including hawks, eagles, ravens, foxes and coyotes, eat ground squirrels. However, in most cases they are not effective in keeping ground squirrel populations at acceptable levels.

Eliminating piles and burrow destruction. Disking up old burrows is an effective way of destroying squirrel habitat, but will sometimes cause squirrels to move further into the fields or into adjoining areas. You should remove brush piles or old cement ditches that provide places for the squirrels to hide and build their burrows. Additionally, this method may best be applied after controlling the squirrel population, to reduce the reintroduction of squirrels into the area.

Trapping. Trapping squirrels work well in towns, around homes, and in areas where you are not able to use baits and fumigants. These are situations where there are a few squirrels present, rather than an entire colony. Research has shown that when trapping Piute ground squirrels, you should use fresh



Piute ground squirrel caught in a live animal trap.

materials such as cabbage or apples. Live animal traps work well but animals must be humanely euthanized after being caught; many states restrict or prohibit the relocation of squirrels in order to control the spread of diseases squirrels might have. Also, trapping is not a science it's an art and can be difficult to master.

Follow-up

For those who live in areas where squirrels are common, an ongoing management program will be necessary, since squirrels will reinvade over time. Once you have controlled a ground squirrel problem, periodically monitor the area for re-infestation. Check for new burrows and start management actions as soon as you notice new arrivals. It is easier and less expensive to manage a small population rather than to allow it to build up to larger numbers. In order to significantly reduce the number of squirrels in an affected area, all the landowners need to implement a control program.

References

- Alberta Agriculture and Rural Development. (2012). Managing Richardson's Ground Squirrels. Accessed at
<[https://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/ba3468a2a8681f69872569d60073fde1/79ae1a8e97fc559a87256a500054bf36/\\$FILE/684-2.pdf](https://www1.agric.gov.ab.ca/$department/deptdocs.nsf/ba3468a2a8681f69872569d60073fde1/79ae1a8e97fc559a87256a500054bf36/$FILE/684-2.pdf)>
- Baldwin, R. A., and Holtz, B. A. (2010). Fumigation of California ground squirrels revisited: are fumigants an effective method for controlling ground squirrels? *Proceedings of the 24th Vertebrate Pest Conference*, 24: 129 -132.
- Marsh, R. (1994). Belding's California, and Rock Ground Squirrels *in* The prevention and control of wildlife damage. Hyngstrom, S., Timm, R., and Larson, G. (eds.). Accessed at
<<http://icwdm.org/handbook/rodents/BeldingSquirrels.asp>>
- Nelson, M., and Messmer, T. (2012). Controlling Townsend Ground Squirrels in Beaver County, Utah. Utah State University Fact Sheet. Accessed at
<https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=2175&context=extension_curall>
- Quinn, N., Dimson, N., and Baldwin, R. (2018). Pest Notes: Ground Squirrel. University of California Agriculture and Natural Resources Publication 7438. Accessed at
<<http://ipm.ucanr.edu/PMG/PESTNOTES/pn7438.html>>
- Rickart, E. A. (1982). The ecology of Townsend's ground squirrel, *Spermophilus townsendii mollis*. Dissertation, University of Utah.
- Rickart, E. A. (1982). Annual cycles of activity and body composition in *Spermophilus mollis*, *Canadian Journal of Zoology* 60, 3298-3306.
- Whisson, D. A., and Salmon, T. P. (2009). Assessing the effectiveness of bait stations for controlling California ground squirrels (*Spermophilus beecheyi*). *Crop protection* 28, 690-695.

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