

CONTROL OF RODENT DAMAGE TO ALFALFA

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The importance of social and political concerns has become one of the major factors in planning and conducting animal damage control throughout the United States. These concerns earlier were directed largely to the large carnivores, wild horses and burros, and other species whose existence is believed by some to be threatened by damage control operations.

More recently this emphasis has included field rodents, common in California and many other states, that have a wide distribution, often with high populations, and frequently cause serious economic damage. One example which clearly illustrates the importance of social and political interests is the ongoing controversy over ground squirrel populations on Fort Ord and Hunter-Liggett military reservations in Monterey County. At the current rate of progress in dealing with this problem, it may well be resolved, at least temporarily, by an epidemic of bubonic plague in the ground squirrels.

There has never been a greater need to recognize social and political interests and their effects than at present. It has been indicated by the Environmental Protection Agency (EPA), Office of Special Pesticide Reviews (OSPR), Washington, D.C., that EPA intends to proceed in 1976 with Rebuttable Presumption Against Registration (RPAR) for all uses of sodium monofluoroacetate (Compound 1080) and fluoroacetamide (Compound 1081), and all aboveground uses of strychnine. The proposed RPAR action is based on "hazard criteria" which relate to toxicity and potential danger to humans and nontarget animals from use of the compounds. If continued registration of the compounds for these purposes is refused by the EPA, their use (except for underground use of strychnine) for control of rodent, rabbit and bird damage will be denied.

How rapidly this process may occur is not clear. It could be completed and the compounds approved or denied for continued use within 180 days after RPAR begins. With possible extensions of time for assembling data to rebut the risks presumed by the EPA-RPAR procedure, the process could take a year or longer. However, cancellation or suspension of registration of these chemicals, by the Administrator of EPA, could occur at any time during the RPAR process. There are, therefore, substantial reasons for concern on the part of industry, agencies, agricultural commissioners and others who are involved in or responsible for use of the chemicals in control of rodent, rabbit and bird damage. Should RPAR deny registration of these compounds, only zinc phosphide and anticoagulants will remain for most purposes in control of these damage problems, except for underground use of strychnine.

Therefore, this review of rodent and rabbit damage control is based on current registration of these pesticides and will not be accurate for any uses which may be denied through the RPAR process, or by cancellation or suspension. Consequently, it will continue to be essential to secure current control recommendations from the Agricultural Commissioners office and/or the Department of Food and Agriculture.

Among the recommended references for damage control in California, the 1975 Vertebrate Pest Control Handbook (Editor: Dell O. Clark) available from the California Department of Food and Agriculture is the most concise, complete and definitive source of specific regulations and control procedures. The Study Guide for Agricultural Pest Control Advisors on Vertebrate Pests from the University of California publications office at Richmond is an additional source of information. Much of this discussion is from these two sources. Specific bait formulations and application techniques are listed in both references. The 1975 Vertebrate Pest Control Handbook is the most current source, but both references are useful in evaluation of damage problems and potential methods of control. Potential hazards to humans and nontarget animals are discussed in both of these references and should be carefully considered before beginning any control procedure.

Field rodents which have the greatest potential for damaging alfalfa crops in California are meadow mice (Microtus spp.), ground squirrels (Spermophilus spp.), and pocket gophers (Thomomys spp.). Other rodents which may cause local damage but are generally less serious pests are muskrats (Ondatra zibethica), beaver (Castor canadensis) porcupines (Erethizon dorsatum), and marmots (Marmota flaviventris).

Rabbits are included in this discussion since their habits are similar and the damage they cause is much like that caused by rodents. Common California rabbits are of two major groups, both of which may cause severe damage at high population levels. One group, the genus Sylvilagus, or true rabbits, includes the cottontail, brush rabbits and pigmy rabbits. The other group includes the genus Lepus, or hares. These are commonly (but erroneously) called snowshoe rabbits and jackrabbits. As a rule, the jackrabbits and the cottontail are the most damaging of these two groups to alfalfa fields due to their widespread distribution and potential for high populations.

Meadow Mice

Meadow mice, also called field mice or simply Microtus, cause a great variety of crop damage. They live primarily in native hay meadows, irrigated pasture, alfalfa, clover, grain, vegetable fields and orchards. They thrive in dense cover along ditch banks, roadsides, fencelines and field edges. They feed on seeds, fruit and succulent stems when available and turn to roots, root crowns and the inner bark of shrubs and trees in late fall and winter.

There are five species in California; Microtus californicus and Microtus montanus are the most important economically. Meadow mice are not wide-ranging animals. Their home range is normally within a 60-foot radius of their burrows. They forage over larger areas where vegetation is sparse and in grain fields. However, when a crop is harvested, or fields are flooded naturally or by irrigation, these mice will move to other areas that provide food and cover. Since they swim readily and well, they survive flooding with relatively little difficulty.

Meadow mice establish a network of runways in dense ground cover. These runways, burrows, stem cutting and root girdling near or below ground level are indications of their presence. They are active all year and forage at any time of the day or night but chiefly during daylight hours. Alfalfa fields provide them with excellent habitat.

Meadow mouse populations tend to peak every three or four years then decline rapidly although the exact causes for these peaks and declines are unknown. Under natural conditions a female may produce from 5 to 10 litters per year. Normally in California this occurs during the major season of forage growth in late winter and spring. Average litter size is 5 to 8 young and they are sexually mature at 4 to 6 weeks of age. Thus a pair of mice may create a population of 2000 to 3000 during an 8-month period, and densities may reach 2000 to 3000 mice per acre.

Meadow Mouse Control

Cultural practices such as clean cultivation and weed control on fencelines, roadsides, ditchbanks and field edges are important measures to prevent growth of meadow mouse populations. Such areas furnish a reservoir for wintering mice and permit them to spread to fields as crops develop. Reduction of cover in orchards and other areas adjacent to alfalfa fields is important in population control.

Some benefits may be provided by predators; coyotes, foxes, badgers, weasels, owl and gulls are some of the species that use these mice as food. However, predation rarely a major factor in control of a rapidly-growing mouse population.

Toxic grain baits are the most useful method for direct control of mice and squirrel. oat groats is the most satisfactory bait. Lightly rolled whole oats or barley are also occasionally accepted well by these mice.

Toxic baits used for spot and 0.29 to 0.5 percent strychnine lightly scattered in runways near	ing are 0.8 per Teaspoon quartive burrows.	zinc phosphide, 0.5 percent 1080 es (about 30 baits per pound) are
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In broadcast baiting for mouse control, the bait is spread evenly by hand, by mechanical ground spreaders, or from aircraft at a rate of 5 to 10 pounds per acre, depending on the density of mouse infestation. Broadcast bait falls through most of the vegetation to the ground surface. Bait should not be applied when trees or grass are wet, or when rain is likely to occur within 24 hours.

Pocket Gophers

Five species of pocket gophers occur in California, all of them in the genus Thomomys. They occupy almost all of the state except for some desert areas, rocky outcrops and the highest mountain meadows. They are most common where ample moisture and good soil encourage abundant plant growth. The pocket gopher is named for the fur-lined external cheek pouch present on each side of its mouth and used for carrying food. They feed primarily on succulent underground parts of plants if available but often do pull entire plants underground for food.

Pocket gophers live almost entirely underground except when the young are weaned and must look for a place to live, or when grazing on plants above-ground near their burrow openings. They are anti-social and solitary except briefly during breeding seasons and when the young are being raised. Other gophers that enter a burrow system are viciously repelled and may be killed. Burrows and their entrances are plugged with dirt to stabilize temperature and humidity. Burrow systems include main tunnels, side tunnels to push out dirt, and the characteristic soil mounds. Main burrows are normally about 4 to 12 inches under the surface but may be much deeper at various points.

Normally, on uncultivated and unirrigated areas, breeding season occurs some time after rains begin and green forage is plentiful. Typically this results in one litter of young per year. On irrigated land, with extended periods of green forage, gophers may breed through most of the year and a female may raise three litters. Litters average 5 or 6 young with a range of one to 13. After weaning the young are expelled and often wander on the surface to find new territories. Gophers are active throughout the year and may reach densities of 50 per acre at high population levels. Legumes such as alfalfa and clover are among their preferred foods; for this reason, fields, pastures and lawns containing alfalfa or clover may attract and support high populations.

Pocket Gopher Control

The belief that gophers can be driven away by "gopher-repellent" plants seems widespread. It is true that fewer will live where plant species they prefer are not present but this is not due to "repellent" plants. Castor bean and caper spurge (often called "gopher plant") are plants commonly believed to repel gophers but there is no solid evidence for this belief. Also, chemical repellents which may be useful for some species have little established value in repelling gophers.

The control measure nearest to a repellent is the use of herbicides to control vegetation. Weedy plants and forbs preferred by gophers can be removed by herbicides and thus reduce gopher populations by decreasing their preferred food supply, but except for control of roadside, ditchbank and other gopher cover, this has little value for alfalfa growers.

Exclusion of gophers by small-mesh wire netting buried to a depth of 24 inches and 10 to 12 inches above ground will usually exclude gophers. This is probably not practical for most alfalfa growers.

For removal of gophers in a small area or where few remain following a baiting program, traps are an effective control method. Runways are located with a probe, dug open with a shovel or trowel, and traps are inserted. Two traps (Macabee or California Pocket Gopher traps) should be placed in the main runway, facing in opposite directions, to make a single set. Two or more sets should be made in the main runway of the burrow system. Traps are secured by wire to a stake on the surface and the opening covered or filled to exclude light. A board over the opening covered with dirt is satisfactory.

Flooding of fields will either drown gophers or drive them out of their burrows and expose them to direct control. Dogs can be trained to kill them, or they can be killed by the irrigator's shovel.

Fumigation of gophers by using gas cartridges, methyl bromide, calcium cyanide and other compounds is generally not satisfactory except for very small areas and few animals. Auto or tractor exhaust gases are probably equally or more effective when piped into burrows but generally this method is too expensive and slow. Fumigation commonly fails due to plugs in the burrow systems and porous soils which allow escape of the fumigant.

Toxic baits are the most widely used gopher control method for large areas. For hand baiting in burrows, 0.2 to 0.5 percent strychnine or 0.2 percent Gophacide grain baits are commonly used. Occasionally vegetable baits are better accepted. For machine baiting, 2.6 percent or lower concentrations of strychnine on grain and 0.2 percent Gophacide baits are used. However, Gophacide is no longer produced and will be unavailable when current supplies are gone.

Toxic baits placed in main burrows are an effective method of reducing gopher populations. Hand baiting is done by using a metal probe to locate the main burrow and placing a small amount of bait (1/2 to 1 teaspoon) in the tunnel. A pointed 1/4-inch steel rod can be used to find the burrow by probing near the fresh mounds. This opening can be enlarged with a larger rod or broomstick to place the bait. If numerous burrows will be treated by this method, a special metal probe should be purchased or built to save time and effort.

On large areas a mechanical "burrow builder" is used to construct artificial burrows 10 to 30 feet apart across the area at the same depth as the natural gopher burrows. The machine drops grain bait in the burrows and covers the tunnel. One to 3 pounds of bait will treat an acre of ground in this method. The operating manual for the burrow builder should be reviewed for specific instructions on operation. Soil moisture and soil types are critical in order that the bait not be covered by collapse of the tunnels. Dry sandy soil and too high a rate of speed in use of the burrow builder are common causes for failure of this control measure.

Ground Squirrels

California ground squirrels include two important species (Spermophilus beecheyi and Spermophilus beldingi) and several subspecies. Beechey, Douglas, Fisher, Belding and Oregon ground squirrels are the subspecies which cause the greatest amount of damage. Grain of all types, fruit, nut, vegetable and field crops are all food for these squirrels. They significantly reduce the amount of forage available where they occur on pasture and frequently cause damage to levees and ditchbanks. They are also associated with spread of several human diseases, including bubonic plague.

Ground squirrels are active primarily during daylight hours and fair weather but during spring and summer they tend to avoid hot midday sun by returning to their burrows. All ground squirrels dig these burrows for shelter, storage of food, rearing of young, aestivation ("summer sleep") and hibernation ("winter sleep"). Adult ground squirrels, depending on subspecies and area, begin aestivation between May and August. Some (Oregon and Belding subspecies) begin hibernation immediately following aestivation. All California ground squirrels at high elevations and some, primarily adults, at lower elevations hibernate during a part of each year. Young ground squirrels may not aestivate or hibernate and may be active throughout the year.

The home range of ground squirrels is normally less than 150 yards across, yet some have been known to migrate as far as 5 miles into new areas. They may live 5 years or more in the wild, but are subject to epizootics of plague, which reduces their numbers dramatically in many cases, and to depredation by carnivores.

Breeding season begins by December in some areas of southern California, but usually occurs during the first half of the year. One litter of young is produced each year, an average of 7 or 8 per litter. As the peak of breeding seasons approaches, the ratio of

males to females in the population active above ground tends to equalize, and control at this time will give maximum results. Shooting a representative sample of squirrels will indicate the arrival of this period; males are easily identified by the enlarged testes.

Ground Squirrel Control

Diseases such as plague may decimate squirrel populations but are not reliable for economic control. Trapping is a practical control method for small populations and where other methods cannot be used. When intensively applied, traps can be useful over fairly large areas but the operation is costly. Livetraps and leghold traps are usually the least efficient. Modified wooden-box type pocket gopher traps are the most useful. These modified traps are placed, unset, in the vicinity of squirrel burrows and are baited with grain, cull nut meats, or similar attractive foods for several days to accustom squirrels to them. When the squirrels are feeding regularly on the bait, the traps are again baited and set.

Fumigants, including carbon monoxide gas cartridges, methyl bromide, and carbon bisulphide, are also effective methods of control for smaller acreages and few animals but fumigation is also less economical than an effective toxic baiting program. Fumigation and trapping are both useful as "clean-up" methods for baitshy ground squirrels.

Toxic baits are the most economical and rapid means of control if properly applied and well-accepted. Squirrel oat groats and whole barley are the most commonly used grains for bait. Dandelion plants or chopped cabbage may be necessary to secure bait acceptance by Oregon and Belding ground squirrels.

Single-dose toxic chemicals used for spot baiting include zinc phosphide at 0.8 percent, Compound 1080 at 0.05 percent (or less), and strychnine at 0.29 percent. For broadcast baiting, chemicals used are zinc phosphide at 1.69 percent or Compound 1080 at 0.11 percent (or less). Strychnine is not recommended for use in broadcast baiting.

Spot baiting with acute toxic baits involves scattering teaspoon-sized quantities on bare ground near the burrows. Bait shouldn't be piled and excessive amounts should not be used. In broadcast baiting, bait is spread evenly by hand, ground machine spreader, or by aircraft through the infested area at a rate of 6 pounds per swath acre.

Anticoagulant chemical baits are also used but a single feeding is not effective. Ground squirrels must feed 5 or more days in succession with no more than 48 hours between feedings. Spot baiting can be used but bait should not be piled in this procedure. The bait should be scattered (about 10 baits per pound) near active runways and replaced every other day for 3 or 4 applications. Bait boxes containing 1 to 5 pounds of bait, replaced as needed on a daily basis, may be more useful in some applications. Replacement bait should be increased in quantity when all of it is eaten overnight. Baiting should be continued until all feeding stops, but moldy or old bait should not be used.

Rabbits

Common California rabbits are the true rabbits (Sylvilagus spp.): pigmy rabbits, cottontails and brush rabbits. At birth the young have very short hair, their eyes are closed (for several days) and they are helpless. They remain in the nest for several weeks until fully furred and able to take care of themselves. The average litter is 5 or 6 young and females may raise 5 or 6 litters per year.

The hares (Lepus spp.) include jackrabbits and snowshoe hares. The blacktailed jackrabbit is common throughout California from sea level to above 12,000 feet. Snowshoe hares and whitetailed jackrabbits are found primarily in northern California and at higher elevations in the east central part of the state. The jackrabbits are the major damaging species. Hares are born fully haired, their eyes are open and they can shift for themselves within a few days. The average litter is 4 or 5 young and females may produce 14 or more young per year.

Both rabbits and hares feed on a wide variety of grasses, shrubs and forbs. They also relish grain and vegetable crops, vines and the bark of young trees. At high population levels, they may totally denude alfalfa and grain fields. Both rabbits and blacktailed hares are most active from early evening to early morning hours.

Rabbit Control

All rabbits and hares are classified as game mammals by the California Fish and Game Code and may be taken by legal sport hunting methods during hunting seasons. This is the most desirable method of control wherever possible. However, property owners and tenants or other persons with written permission from the owner or tenant may take cottontails and brush rabbits at any time when they are causing damage. Blacktailed jackrabbits may be taken in any manner when causing damage but if steel-jawed leghold traps are used, they must comply with Fish and Game Code requirements.

Blacktailed jackrabbits may be controlled by the use of 0.3 percent strychnine, or 0.005 to 0.025 percent anticoagulant treated baits. Rolled barley, whole oats and squirrel oat groats are acceptable baits. Milo and barley heads, alfalfa leaves and stems, carrots, sweet potatoes, parsnips and cull apples are other baits which have been successfully used. Spot or feeder station baiting are the only methods recommended and prebaiting is usually necessary.

In spot baiting, small handfuls of untreated bait are placed along trails used by the rabbits at a distance of about 100 yards from the field where damage is occurring. Occasionally it may be necessary to prebait around the perimeter of the field. The amount of prebait should be adjusted daily until only a slight amount is left at each location. Prebaiting should continue for 3 to 5 days or until prebait is well-accepted. When this occurs, if strychnine bait is used, all prebait is removed and a small quantity (one tablespoon) of treated bait is placed at precisely the same spots where prebait was accepted. One application is normally sufficient to reduce the rabbit population.

Toxic bait should not be placed where hazards may occur to livestock, pets, or non-target wildlife. All uneaten bait material should be picked up on the second day following baiting and all dead rabbits should be disposed of by deep burial or burning.

Anticoagulant baits should be used in self-dispensing feeders protected from livestock. One to 5 pounds of bait is placed in feeders in areas frequented by rabbits. Stations should be inspected daily and bait replaced as needed. Several days may be required before bait is accepted and several days of feeding are required to control rabbit populations. Bait must be eaten on 4 or 5 successive days with no more than 48 hours between feedings. Bait should be exposed until all feeding stops and moldy or old bait should be replaced with fresh material. All bait should be picked up and disposed of when control is completed. Dead rabbits should be picked up daily for deep burial or burning.

Marmots

Marmots (Marmota flaviventris) are found primarily in the Sierra Nevada range and the northeastern part of California. They are members of the ground squirrel family with somewhat similar habits. They have a single litter of young, usually 4 to 6, each year. They feed primarily on plants and are serious pests in alfalfa fields.

Marmot Control

Shooting is effective and is a common method of control in eastern states. Where shooting is safe, this may provide one of the better methods of control of small populations. Marmots may also be taken with suitable leghold traps and fumigants can be effective in their burrows.

Toxic baits of 0.35 percent strychnine on dandelion leaves or alfalfa tips cut to 2-inch lengths are used in small quantities (about 40 baits per pound) in rock crevices or at the burrows used by marmots. Caution should be used when livestock are in treated fields to insure that they do not have access to baits.

Porcupines

Porcupines (Erethron dorsatum) are common pests in orchards and timber but less often cause serious damage to alfalfa fields. Their numbers are partially limited by reproduction one young (rarely 2) are born each year during the spring. They are slow-moving and clumsy and are most active at night. They are found in much of northern and east central California, primarily in the mountain and foothills area.

Porcupine Control

Hunting porcupines with firearms is quite effective in winter months, and along trails where they frequent fields during spring and summer. They are easily tracked in snow and are frequently seen in trees, even during summer months. They are easily trapped with suitable leghold traps at trees they climb and where they travel through fences. Salt blocks containing 5.79 percent strychnine are occasionally effective in trees which are used heavily by porcupines. The blocks should be firmly attached to the tree, about 8 inches above a large limb and at least 10 feet off the ground.

Muskrats

Muskrats (Ondatra zibethica) are not normally a serious problem in grazing alfalfa fields but do frequently burrow into ponds, irrigation canal banks and levees. Thus, the major problem is loss of irrigation water and costly repairs to canals and headgates. Muskrats are found throughout the Sacramento and San Joaquin Valleys, in northeastern California, and in the Colorado River area including the Imperial Valley. Some are also scattered along the coastal area.

Muskrats are active throughout the year and are more active at night but if not disturbed are also active during daylight hours. Young may be born at any time of the year but fewer are born in winter. Usually there are 5 or 6 young per litter and 2 or 3 litters may be raised each year. Muskrats are classified as furbearing mammals in the California Fish and Game Code.

Muskrat Control

Shooting muskrats is possible but may be dangerous and is time consuming. They are easily trapped and their fur is valuable when taken during the regular trapping season. Trapping when fur can be salvaged is preferable to other methods. Both leghold and Conibear (Size #110) traps are effective when set in their burrows. Fumigants can be used in their burrows when canals and ponds are drained.

Rolled barley or steel-cut oat groats treated with anticoagulant compounds (0.005 to 0.025 percent) are used in baiting. Paraffin bait blocks formed around sticks used to hold them upright are effective when placed at runways, near burrows and other locations where activity is evident. Floating bait boxes containing anticoagulant bait are also quite effective. In both cases, sufficient bait should be supplied for as long as the bait is eaten.

Beaver

Beaver (Castor canadensis) are common in much of California and frequently cause damage by blocking irrigation canals and headgates. Flooding of fields and roads is frequent under these conditions although beaver do not normally damage alfalfa extensively by feeding. However, damage to timber and fruit trees is common. Beaver are also active throughout the year. The females have one litter of 2 to 6 young (normally 2 or 3) annually.

Beaver Control

Beaver are also classified as furbearers by the California Fish and Game Code. They may be harvested in certain areas during the established trapping season, by using leghold or Conibear #330 traps. When causing damage they may be taken by shooting or trapping under authorization of a permit which must be secured from the California Department of Fish and Game. The local game warden or agricultural commissioner can provide necessary information for securing permits.

Summary

There are reasons for concern regarding the use of damage control methods and a great need to consider social and political interests and values. It is extremely important to consider potential hazards in the application of control methods and to employ those methods which maximize benefits and minimize risks to nontarget species. The need for damage control will continue and it is essential that effective control methods be available. Concern for other social values in planning and applying damage control is essential to preserving these methods.

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