FIELD RODENT CONTROL IN ALFALFA

Jerry P. Clark[1]

Abstract

Vertebrate pests such as ground squirrels, pocket gophers and meadow voles can cause a wide variety of problems for California growers. Besides consuming above and below ground plant parts, burrowing animals can impede various farming operations, resulting in loss of production. Growers should implement Integrated Pest Management (IPM) procedures when initiating a rodent control program. The most effective programs utilize knowledge of the pest life cycle, feeding habits and other behavioral activities. The use of various toxicants, such as zinc phosphide and strychnine and the fumigants (aluminum phosphide, acrolein, gas cartridge) are discussed for each vertebrate pest species.

Introduction

There is an entire range of problems that can be associated with vertebrate pests in alfalfa. They consume both the above and below ground portions of the plants. Burrowing activity can disrupt farming operations, irrigation systems, and in some cases cause damage to equipment that strikes the earth mound or sinks in a burrow. Burrow mounds also can cover nearby plants, resulting in a loss of production.

The Belding ground squirrel causes extensive damage to alfalfa production in Modoc County as well as other northeastern counties of California. Exclusion cylinders studies in Modoc County demonstrated that the Belding ground squirrel can reduce alfalfa production by an average of 1,100 pounds per acre of first cutting alfalfa. This alfalfa damage was a composite of trampling, runway development, squirrel mounds, vegetation clipping, and forage eaten.

Principles of Field Rodent Control

Animal population numbers change according to the situation in which they live. The actual mechanisms for these adjustments are unknown in many cases, but factors such as stress, disease, hunger and fertility are important. No area can support unlimited growth, even if surplus food, water, and shelter are available. Consequently, animals tend to limit their numbers to match the capacity of the area in which they live. However, if food, water or shelter is reduced below the species' requirements, that population will decline. This simple concept is the basis of habitat modification as a method of reducing animal numbers in a given area. Unfortunately, in many agricultural situations habitat modification is not feasible or practical. In these cases, population control is often necessary.

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[1]Jerry P. Clark, Primary Staff Biologist, California Department of Food and Agriculture, 1220 N Street, P.O. Box 942871, Sacramento, California, 95814.

Legal Requirements

Most mammals are protected by the California Fish and Game Code. When certain wildlife species are found damaging growing crops or other property, they may be taken (controlled) at any time, and in any manner by the owner or tenant of the premises. Common agricultural pests that fall under this category are ground squirrels, pocket gophers and meadow voles.

Integrated Pest Management for Field Rodents

When population regulation of a vertebrate pest is necessary, an integrated approach should be developed using knowledge of the animal's ecology and behavior, as well as information on all control techniques available. The major components of an IPM program consist of: 1) accurately identifying the pest species; 2) using available methods and materials to reduce damage; and 3) monitoring the area to detect reoccurrence of the pest population. This type of IPM program will generally result in an environmentally and economically acceptable approach which significantly reduces vertebrate pest damage.

When to Control

To some the answer to when to control a particular vertebrate population is "whenever individuals from the population are detected". While this is appropriate for some species or in specific situations, a good IPM program will base the decision on a system which incorporates monitoring of the pest populations. When the population density reaches the threshold level, i.e. the level at which control is economically justified, control should be undertaken. Threshold levels for vertebrate pests have not been determined, so control decisions are generally based on other factors such as past experience.

The timing of a control program, as well as what methods and materials to use, will depend on the pest species present, the specific method of farming, and the availability of equipment and labor. Information on other vertebrate pests which may cause damage is available in the Vertebrate Pest Control Handbook (Department of Food and Agriculture, 1220 N Street, Sacramento, CA 95814, $17.00). This handbook is currently being revised and will be available for sale next year.

The most successful wildlife control programs use the techniques best suited for the specific situation. These include habitat modification, behavioral manipulation, and population reduction. These techniques can be combined to make an effective damage control program.

GROUND SQUIRRELS

Biology

Ground squirrels live in a wide variety of natural habitats but are particularly dense in man-disturbed areas such as roads or ditch banks, along fence rows, around buildings, and within or boardering many agricultural crops. They live in groups or colonies and spend much of their

time underground in burrows where they sleep, rest, rear young and escape danger. The burrows are also important for storing some food and as a relatively safe place for the animals to estivate (sleep) in summer and hibernate in winter. Ground squirrels are active during the day and are easily seen from spring through fall, especially in warm, sunny weather. They live in burrows but frequently venture out for food and social interaction.

The ground squirrel's life cycle is rather unique, and a thorough understanding of it greatly assists in developing a sound control program. Ground squirrels breed once a year in the early spring with a litter size of 7 to 8. The exact date of reproduction varies depending on local environmental conditions. Approximately 6 weeks after birth, young ground squirrels emerge from their burrow system for the first time.

During certain periods of the year, ground squirrels remain in their burrows for long periods. This occurs in the summer when excessive heat is experienced for several days, and in the winter. Any of the adult ground squirrels will estivate for several weeks or longer in the summer. During the winter, most adult ground squirrels hibernate until the following spring. Understanding this life cycle is important so you can understand how ground squirrel populations fluctuate during the year. For example, you may see a virtual explosion in the number of ground squirrels in late spring when the young are emerging from the burrows for the first time. Conversely, in the fall, you may see a drastic reduction in the number of squirrels observed. This is not necessarily a result of a control program, predator, or a disease, but simply the biology of the animals.

The feeding habits of ground squirrels must also be understood if effective control is to be achieved. Ground squirrels are primarily vegetation eaters. However, the type of vegetation consumed changes from one season of the year to the next. In early spring, their diet consists basically of green material such as grasses and leaves. As these begin to dry, and the annual seed crops become available, ground squirrels tend to switch their diet to seeds. When designing a baiting program, these changes are very important. If grain (seed) based baits are used during the period when grass is preferred, the squirrels may not consume a sufficient amount of the bait to achieve adequate control. On the other hand, when ground squirrels are readily taking grain, grain-based toxicants can be used most effectively.

Control

An integrated approach should be taken using knowledge of the animal's ecology and behavior as well as information on the techniques available for ground squirrel control. Selection of the proper control method will depend primarily on the time of year, the species or subspecies involved, location and size of the field, and the severity of the squirrel problem.

Single-Dose Squirrel Baits

The only acute rodenticide registered for ground squirrel control is zinc phosphide*. It is most effective when acceptance of seeds and grain is best and when squirrel activity aboveground is at its greatest. This is generally limited to late spring when young have been born and are active aboveground (May-June) and fall, after summer estivation, when activity is again high (September-October). Zinc Phosphide is generally ineffective against the Belding ground squirrel.

Multiple-Feeding Squirrel Baits

In recent years, the use of anticoagulant baits for squirrel control has increased substantially. Although anticoagulants are more expensive to use, their safety to humans and other nontarget species plus their high degree of efficacy have been contributing factors to their increasing popularity.

Squirrels must feed on anticoagulant baits for 5 days or more without gaps of 48 hours or longer before they die from internal hemorrhaging. Diphacinone and chlorophacinone treated grain baits are registered for ground squirrel control. These anticoagulant treated grain baits are available from most County Agricultural Commissioner offices. The bait formulations are 0.005% for bait stations and 0.01% for spot broadcasting.

Most applications are made by use of bait stations placed in infested areas about 100 to 200 feet apart. Bait stations should allow entrance of the squirrel while excluding children and domestic animals. They also provide a clean dry place to store adequate amounts of bait to last several days to a week. Labels call for placement of 1 to 5 pounds of bait in each station. Bait stations are usually made out of wood or plastic irrigation or drain pipe. Two entrances about four inches in diameter are placed opposite each other. A lip for preventing bait from being spilled or kicked out should be installed. Since eating an anticoagulant does not immediately affect the squirrel's feeding or activity, you will probably notice apparently healthy squirrels feeding at the bait boxes for several days. These animals will soon be affected but it is important that they continue to have a supply of bait available.

Repeated spot baiting with anticoagulant treated grain bait can be effective in controlling ground squirrels. Scatter a handful of bait (about 10 baits per pound) evenly over 40 to 50 square feet near active burrows or runways. Retreat every other day for three to four applications. An uninterrupted supply of bait should be available for six to eight days. Scattering takes advantage of the squirrel's natural foraging habits and helps prevent domestic livestock and wildlife from picking up bait. Never put bait in piles.

Fumigation

Ground squirrels can be killed in their burrows by using toxic gasses. Fumigation is most effective in the spring when soil moisture is generally high. At this time the gas is contained in

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the burrow system and does not diffuse into small cracks that are often present when the soil is dry. Also, this is the breeding season and all squirrels will be active. Fumigation is not recommended for ground squirrel control during periods of hibernation or estivation because squirrels plug their burrow system with soil, preventing the gas from reaching the sleeping animals. This is not usually obvious by looking at the burrow entrance because the plug occurs deeper in the burrow.

Aluminum Phosphide* (Phostoxin®, Fumitoxin®) and gas cartridges are effective fumigants for controlling the California ground squirrel. They haven't proven to be very effective against the Belding ground squirrel. This may be due to the cold dry soils in the spring.

Aluminum phosphide is formulated as solid tablets which upon exposure to the atmosphere, decomposes and liberates hydrogen phosphide (phosphine) gas. The gas is colorless, heavier than air, and has a pungent, garlic-like odor. The label recommends that 2 to 4 tablets be placed in each active burrow opening. Seal tightly by shoveling dirt over the entrance after first packing the opening with crumpled newspaper. This will prevent soil from covering the tablets. Use lower rates in small burrows under moist soil conditions and higher rates in large burrows when soil moisture is low. Check treatment area after 72 hours and retreat as before all opened burrows.

Acrolein* (Magnacide® H) was registered last year as a fumigant for controlling burrowing rodents, such as the California and Belding ground squirrels. Acrolein is a colorless gas which is very irritating to the eyes at low concentrations. The nozzle of the applicator device is placed as far into the active burrow entrance as possible. Shovel soil onto the applicator device and the burrow entrance to create a seal that will prevent loss of gas. Dispense fumigant at the rate of 20 cc per burrow. Withdraw the applicator device and seal the burrow opening by tamping it tightly.

POCKET GOPHERS

Biology

Five species of pocket gophers (Thomomys spp.) are found in California. They occupy 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, such as in alfalfa fields. The pocket gopher is named for the fur-lined external cheek pouch present on each side of its mouth which is used for carrying food. They feed primarily on succulent underground parts of plants, but often do pull entire plants underground for food. They also graze on plants aboveground near their burrow openings.

Pocket gophers live almost entirely underground except when the young leave the nest to look for a new place to live. They are antisocial and solitary except during breeding and when the

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young are being raised. Burrow systems include main tunnels, side tunnels to push out dirt, and the characteristic soil mounds. Main burrows are normally 4 to 12 inches under the surface but may be deeper in certain situations. Burrow openings are plugged with soil so the system is completely enclosed, stabilizing the burrow's temperature and humidity at close to optimal conditions.

On uncultivated and unirrigated areas, the normal breeding season occurs after rains begin and green forage is plentiful. Typically this results in one litter per year. On irrigated land, the extended periods of green forage allow gophers to breed most of the year, and a female may raise up to three litters per year. Litters of 5 or 6 young are common. After weaning, the young leave the burrow and wander aboveground 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 and when these food items are present, high populations of gophers often occur.

Control

Many pocket gopher control techniques are not feasible for use in alfalfa, except in very special situations. Fumigation of gopher burrows using gas cartridges and aluminum phosphide is generally not satisfactory except for very small areas with few animals.

Acrolein* is registered for gopher control in alfalfa. Preliminary trials conducted last year in Siskiyou County appeared promising. Active gopher mounds should be opened with a shovel, exposing the tunnels. Place the nozzle of the acrolein applicator into the tunnel opening. Shovel soil over the applicator before dispensing the fumigant at an application rate of 20 cc per tunnel opening. A second acrolein application may be required after two days.

Strychnine* is the most economical and efficacious of the rodenticides available for gopher control in alfalfa. Currently all strychnine gopher baits sold to growers in California are formulated by commercial firms like Wilco Manufacturer and Distributors, Inc., and Oregon Rodent Control Outfitters. Baits range from 0.25% to 1.8% strychnine, with the latter bait formulation for use only in the tractor-drawn gopher machine or burrow builder.

Mechanical Baiting

The mechanical bait applicator offers an excellent way of controlling gophers over large areas with a once-over operation. This tractor-drawn device constructs an artificial burrow beneath the soil surface and deposits strychnine treated grain bait within the burrow at preset intervals and in preset quantities. The operator needs to drive the machine back and forth across a field at regularly spaced intervals to make a series of parallel burrows, ordinarily about 20 to 25 feet apart. The burrow that is formed will intercept most of the natural gopher burrow systems, and gophers, by nature, readily explore these artificial tunnels and consume the bait they find within them.

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Until recently, two manufacturers dominated the market for building gopher machines; Rue R. Elston Co., Minneapolis, Minnesota, and Blackwelder Manufacturing Co., Rio Vista, California. Unfortunately, Blackwelder is no longer manufacturing gopher machines. The Elston machine is more popular in the Midwest but is also commonly used in the West.

MEADOW VOLES

Biology

Meadow vole populations are extremely cyclic, reaching a peak about every four to six years, then falling to a period of relative scarcity, which is then followed by another breeding surge. The gestation period is approximately 21 days, with an average litter size of eight. Breeding can occur throughout the year. Voles are very short-lived animals. Their maximum life span has been estimated as being from 10 to 16 months, but in all probability, few individuals ever attain such age. Voles do not hibernate. They forage at anytime during the day or night. Meadow voles are primarily territorial, occupying a home range of a few square yards. The young adults of each litter, after being weaned at the age of two or three weeks will normally seek new territorial domains, providing there is suitable food and cover. Vole infestations in good habitat, like alfalfa, will normally begin as small isolated colonies on grassy borders adjacent to the crop. As the vole population increases in number, the young adults will move into the crop. Voles will usually have a network of 1 1/2" wide runways that are connected with shallow underground burrows. The burrows are approximately 2" in diameter with entrances always open.

Survey

The best time to survey for vole activity is before the crop is planted and at monthly intervals during the growing season. The grower should look for signs of vole activity in areas such as grassy borders adjacent to the crop, weedy ditch banks, roadside and railroad right-of-ways. An individual should walk through these areas looking for vole runways, fresh soil at burrow openings, fecal deposits in runways, and cutting of grass in runways or near burrow entrances. Voles may also be seen darting down the runways.

Control

Cultural Practices: Clean cultivation and weed control on grassy borders adjacent to crops, weedy ditch banks, railroad right-of-ways, and roadsides are important preventive measures. Since these areas furnish a reservoir in which wintering vole populations may expand and immigrate to adjacent crops, it is important to keep these areas clean of vegetation.

Poison Baits

Zinc phosphide* treated grain baits (200%) are very effective in controlling vole populations in alfalfa. There are no established crop tolerances for zinc phosphide in alfalfa, therefore it can be applied only during the dormant season of growth. The most effective method of application is to broadcast the grain bait over the alfalfa. This enables the voles to find the bait on the runways and near burrow entrances. Aircraft or a mechanical spreader mounted on a pick-up truck are often used to broadcast the bait. There are several special-use restrictions on the zinc phosphide label for alfalfa. Aircraft applications are restricted to fields over 100 acres in size. Truck mounted spreaders are used on alfalfa fields under 100 acres. Applications by air or ground equipment must leave a band of untreated alfalfa, 100 feet wide on all sides of treated fields. No bait may be applied, by any method, in this buffer zone. This is to protect nontarget birds like pheasants that may feed along the alfalfa borders.

Zinc phosphide* treated grain bait is applied through the infested areas at 5 to 10 pounds of bait per acre, depending on the density of the infestation. No more than two applications per year are allowed on the same acreage.

There are endangered species considerations that must be considered when using zinc phosphide treated bait in alfalfa. Do not use this bait within 100 yards of habitats occupied by the following species: **Amargosa vole** (*Microtus californicus scirpensis*, Inyo County); **Fresno kangaroo rat** (*Dipodomys nitratoides exilis*, Fresno County); **Giant kangaroo rat** (*D. ingens,* Kern, Santa Barbara, Kings, San Benito, And San Luis Obispo Counties);**Morro Bay kangaroo rat** (*D. heermani morroensis*, San Luis Obispo County); **Point Arena mountain beaver** (*Aplodontia rufa nigra*, Mendocino coast in Point Arena area); **Salt march harvest mouse** (*Reithrodontomys raviventris*, Alameda, Contra Costa, Marin, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties); **Stephen's kangaroo rat** (*D. stephensi,* Riverside and San Diego Counties); and **Tipton kangaroo rat** (*D. nitratoides*, Tulare County).

The California Department of Agriculture has contracted with the Denver Wildlife Research Center to develop a food tolerance for zinc phosphide in alfalfa. This research will begin next year in Modoc and San Joaquin counties.

Conclusion

Vertebrate pests such as gopher, ground squirrels, and voles can significantly reduce alfalfa production in California. However, a number of toxicants are available to the growers. Utilizing these materials in an integrated pest management program will prevent substantial crop losses and minimize potential impacts to non-target species.

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