CHAPTER 11

Vertebrate Pests

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Several vertebrate pest species currently cause economically significant damage in vineyards. These include pocket gophers, meadow voles, ground squirrels, rabbits, and deer (Flaherty, Christensen, and Lanini 1992). Pocket gophers are probably the most widespread and significant pests, with economic losses resulting from their feeding on the roots of vines, their gnawing on irrigation lines, their burrows diverting irrigation water and causing erosion, and their mounds impeding other management practices. Meadow voles, ground squirrels, rabbits, and deer may also cause significant damage by feeding on the vines.

Current knowledge indicates that cover cropping in vineyards increases most mammal pest problems by providing additional food and cover resources that favor higher population levels (Hansson 1975; Nicholson and Richmond 1984; Sullivan and Hogue 1987; Edge, Wolff, and Carey 1995). However, the magnitude of the effect of cover cropping on these populations may vary depending on the location of the vineyard, history of the pests in the area, and the type of cover crop selected and its management. The potential effect of a cover crop on vertebrate pest populations should be considered prior to planting. In many cases, the benefits of a cover crop may more than outweigh the expense of the additional vertebrate control required or the additional damage that may occur in spite of control efforts. Further, the anticipated increase in vertebrate pest problems may, in part, be offset by the species or management of the cover crop. In some situations, such as in newly planted vineyards, the only option to avoid costly damage by mammal pests may be to delay planting a cover crop for 1 or 2 years.

There has been little specific study on how cover cropping affects vineyard vertebrate pest populations. Most of what is known is derived from food habit and preferred habitat studies, as well as from studies conducted in orchard cover crops and field crops. Some parallels can also be drawn from experiences in reforestation and from studies of no-till agriculture.

Pocket Gophers

Food quantity and quality are the major factors influencing the distribution and abundance of pocket gophers (*Thomomys bottae*) throughout their range (Hansen and Ward 1966). Because breeding is regulated by the availability of green forage, under irrigated conditions (e.g., alfalfa fields) pocket gophers may breed year-round, resulting in high population densities (Case 1989; Loeb 1990). Therefore, an increase in food supply by planting a cover crop favors this pest and can lead to an increase in population density.

Although the food habits of pocket gophers suggest that they prefer to feed on the cover crop rather than on the vines, when the cover crop dies or is removed, pocket gophers may be forced to turn to the vines for food. If pocket gopher densities are higher than normal as a result of the abundance of food resources provided by the cover crop, the damage may be quite severe. This theory is supported by observations of gopher damage to conifer seedlings in reforestation. Gopher feeding pressure on seedlings temporarily increased after a herbicide application that reduced the gophers' natural food (Boyd 1987).

Because newly planted vineyards are highly susceptible to damage by pocket gophers, in areas having a history of pocket gopher problems it may be advisable to delay planting a cover crop for 1 or 2 years until the vines are able to withstand some feeding damage. In some instances, it may be possible to reduce the potential for damaging populations to develop by preparing the site to reduce the initial population of gophers, considering the species and blend of cover crop to be planted, and giving more attention to monitoring and control efforts.

Site Preparation

Traps and poison baits can reduce the number of pocket gophers in a vineyard prior to planting the cover crop. Because most of a pocket gopher's burrow system is usually 8 to 12 inches (20 to 30 cm) below the ground, deep plowing and disking may destroy much of the burrow system and kill some of the gophers (Marsh and Steele 1992).

If possible, pocket gophers should also be controlled in neighboring areas to reduce the risk of invasion. Studies of pocket gophers in forested areas have indicated that a buffer strip that is free of pocket gophers should be at least 200 feet (61 m) wide (600 feet [183 m] is preferred) to slow down the rate of invasion (Marsh and Steele 1992).

Species Selection

Pocket gophers are strict herbivores that exhibit a preference for fleshy and succulent roots and stems of herbaceous annual and perennial plants (e.g., alfalfa and clovers) rather than grasses with fibrous root systems (Ward 1960; Vaughan 1967; Cox 1989; Jenkins and Bollinger 1989). Food preferences appear to be based on the fiber to protein ratios of plants. Gophers are able to assimilate more protein from plants that are low in fiber (Jenkins and Bollinger 1989).

Although pocket gophers are adaptable in their feeding habits and eat alternate food sources when preferred foods are scarce (Ward 1973; Burton and Black 1978), populations usually decline under these circumstances (Black and Hooven 1977). In a study of pocket gopher control on a mixed forb-grass rangeland in Colorado, an 83 percent reduction in forbs after a herbicide application resulted in an 87 percent decrease in the number of pocket gophers (Keith, Hansen, and Ward 1959).

Pocket gopher food preferences should therefore be considered when selecting a cover crop blend. Cover crops that include grasses or cereals with fibrous root systems, rather than strongly taprooted legumes, may limit the amount of forage available to pocket gophers and thereby reduce the potential for large populations to develop. It is important to note that some grasses that are high in moisture content (such as California brome) are favored by pocket gophers and also should be avoided (Burton and Black 1978; Marsh and Steele 1992).

Meadow Voles

Ground vegetation, by providing food, concealment from predators, and protection from unfavorable weather, is the most important factor affecting meadow vole (*Microtus* spp.) abundance (Birney et al. 1976; Tobin and Richmond 1993). Where cover crops are planted, vole populations are almost certainly favored, and without careful management, damage may be severe enough to kill many vines, especially in young plantings.

Cover crop management should reduce protec-

tive cover and eliminate contact between the vines and the cover crop or clippings. Cultural methods include species selection, cultivation, mowing, and the use herbicides. Practices that reduce cover in surrounding areas can also play a role in preventing serious vole problems, because these areas often provide habitats for voles. These practices include controlling weeds; cultivating fencerows, roadsides and ditchbanks; and reducing ground cover in areas adjacent to the vines.

Species Selection

Growth form is probably the most important consideration in selecting ground cover plants that are unfavorable to voles (Baker and Brooks 1982; Nicholson and Richmond 1984). Dense covers that form a continuous canopy support high vole populations. By contrast, plants with erect bunch-type growth or covers that reach a short mature height require less mowing and increase the light penetration at ground level and provide voles with little protective cover (Brooks and Struger 1985).

Food preferences also should be considered when selecting a cover crop that will not contribute to increased vole populations. Meadow voles forage almost exclusively above ground on fresh leaves and stems of a wide variety of grasses and broadleaf plants. Seeds, woody materials, and bark are eaten when green foods are of low quality or in short supply (Batzli 1985; Tobin and Richmond 1993). Voles exhibit preferences for foods that are characterized by high water or calorie content or have nutrients such as nitrogen, calcium, phosphorous, and sodium (Thompson 1965; Brooks and Struger 1985; Batzli 1985). The planting of legumes and grasses that have a high moisture content should therefore be avoided if vole problems are likely.

Although some investigators have demonstrated adverse effects of toxic or low-quality forage on vole growth, reproduction, and survival (Lewis, Rhodes, and Richmond 1983; Batzli 1985; Jean and Bergeron 1986; Marquis and Batzli 1989), the utility of such plants in cover crops is inconclusive (Tobin and Richmond 1993). Some grasses, notably fescues, are commonly infected with an endophytic fungus that may play a role in reducing vole fecundity (Coley et al. 1995). Many fescues today are sold under certification as endophyte-free, which therefore do not inhibit vole reproduction.

Cultivation

Care should be given to not allow vegetative cover to build up so that it direc0tly contacts vines. This discourages voles from living near and causing damage to the bases of vines (Holm, Gilbert, and Haltvick 1959; Sullivan and Hogue 1987; Tobin and Richmond 1993). In areas that have a history of vole problems, summer disking or mowing of the vegetation in the row middles also should be considered to prevent the buildup of cover that may harbor voles. If vole numbers increase substantially, clean-culture cultivation and plowing, along with lethal control measures, may be the only way to eliminate the problem.

Cover Reduction

Frequent close mowing of ground cover, which removes protective cover for voles and allows detection of their presence (Byers 1985; Godfrey 1985; Sullivan and Hogue 1987), should be undertaken where possible. Mowing may also have a short-term impact by disturbing vole populations, causing individuals to disperse (Edge, Wolff, and Carey 1995). It is important to note, however, that clippings left as a dense thatch layer on the ground are likely to improve the suitability of the habitat to voles by affording them more protection (Tobin and Richmond 1993). There is a greater potential for damage to occur if clippings are left along the vine row.

Rabbits and Hares

Although rabbits (*Sylvilagus* spp.) and hares (*Lepus californicus*) readily graze on most species of cover crops, they are especially attracted to alfalfa, clovers, vetches, beans, peas and perennial grasses, which provide them with a good source of protein. Planting these species in a cover crop may therefore result in increased rabbit populations and rabbit damage.

Because rabbits often invade vineyards from adjacent fields, manipulation of a cover crop is unlikely to have an effect on rabbit populations or rabbit damage. However, a reduction in cover around vines may make rabbit damage easier to detect and may also aid in determining the severity of the problem. Fortunately, grapevines quickly grow beyond the reach of most rabbits and hares after 1 year. However, newly planted vineyards are at risk from damage by rabbit feeding if cover crops are planted concurrently. Care should be taken to protect newly planted vines by constructing exclusion fences around vineyards or using vine guards

until the vines are at least 3 feet (90 cm) high. Once established, rabbits and hares may continue to feed on the cover crops but the vines should be well out of reach.

Ground Squirrels

California ground squirrels (*Spermophilus beecheyi*) tend to disappear from land that is under complete and frequent cultivation. However, they maintain burrow systems along fence lines, road rights-of-way, and other uncultivated areas and will travel 100 yards (90 m) or more to feed in adjacent crops. After their spring emergence from hibernation, ground squirrels feed almost exclusively on green vegetation. When annual grasses and forbs begin to produce seed and dry up, squirrels begin eating seeds and fruits, as well as bark from vines and trees. Because alfalfa, clovers, vetch, beans, peas, and perennial grasses are highly attractive food sources to ground squirrels, the presence of these in a cover crop may cause ground squirrels to spend longer periods of time in the vineyard, potentially causing more damage to vines.

Lethal control measures applied to ground squirrel populations on the perimeter of vineyards reduce the potential for damage to vines and fruit. Removing piles of prunings and other debris from fields and their margins also may make the habitat less suitable to ground squirrels. This also makes detection of squirrels and their burrows easier, helps in monitoring the population, and improves access to burrows during control operations.

Deer

Deer (*Odecoileus hemionus*) can cause significant damage to vineyards in areas where nearby habitat, especially wooded or brushy areas, provides cover. Some deer may be permanent residents of the areas, while others may be migratory, spending winter and spring around the vineyard and summer and fall at higher elevations. Certain species of cover crops may enhance the habitat for deer by providing them with an additional food source. In areas where deer are present, consideration should be given to the species of cover crop selected.

Species Selection

Deer prefer forage crops that are high in protein. If a cover crop includes legumes (clover, vetch, etc.) it may prove highly attractive to deer. Though less attractive, grass cover crops may also potentially attract heavy deer browsing, depending on the availability of preferred forage in adjoining areas.

Pest Management Guidelines

A cover crop may make the signs left by pests (e.g., earth mounds created by pocket gophers) more difficult to detect, causing damage to become more severe before it is discovered and control action is taken. A regular monitoring program for early detection of increasing pest populations and damage is therefore particularly important where cover crops are used. In addition to monitoring pest populations and damage in the vineyard, surrounding areas should also be routinely checked for signs of animals so that the potential for reinfestation can be assessed. Inspections of cropped and adjacent areas should be undertaken at monthly intervals, although this frequency may vary depending on the history of vertebrate pest damage in an area. The information provided in table 11-1 may be used to assist in the development of a monitoring program and the selection of management options for minimizing damage for each of the major pest species.

Table 11-1. Vertebrate pest species, damage, and control recommendations for vineyards where cover cropping is practiced

Species	Signs	Cover crop management	Alternate controls
Pocket gopher	Plugged burrow systems; earth mounds; girdling of vines below ground; stunted vines; damage to irrigation lines	Species selection (grass rather than legumes); mowing to reduce cover and facilitate early detection of mounds	Flood irrigation; toxic baits; trapping
Meadow vole	Runways and open burrow entrances; presence of scats; girdling of vines above ground	Species selection (erect bunch-type growth or short plants, avoid high-moisture plants); maintenance of a cover-free strip around bases of vines; mowing to reduce cover	Vine guards; toxic baits
Rabbits and hares	Feeding on foliage and fruit; girdling or complete cutting of vines above ground; observation of activity	In morning and evening delay planting cover crop until vines are approximately 1 year old	Exclusion fence; vine guards; shooting; toxic baits (black-tailed jackrabbit)
Ground squirrel	Girdling of vines above ground; feeding on foliage and fruit; gnawing on irrigation lines; observation of day activity; burrow systems, especially on perimeter of vineyard	None	Toxic baits; burrow fumigation
Deer	Stripping of foliage from vines; breakage or scarring of young vines; presence of scat and footprints	Species selection (grass rather than legumes)	Exclusion fences

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