# Rodents And Cover Crops—A Review

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# RODENTS AND COVER CROPS—A REVIEW

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ABSTRACT: Inter-row plantings of herbaceous cover crops has become a widely accepted practice by orchard and vineyard managers. Cover crops, used as part of a production management system, are not considered a cash crop and are therefore selected by individual growers for various reasons. Little is written regarding the relationship of cover crop management and the impact on rodent populations. This paper reviews the recent literature and examines how cover crop species and cultivar selection along with management procedures may be influential in limiting rodent populations and their damage to cropping systems.

KEY WORDS: vertebrate pests, cover crop, field rodents

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## INTRODUCTION

From a managerial perspective cover crops offer a number of benefits to an orchard or vineyard manager. Cover crop species selection may include the planting of annual and/or perennial legumes and grasses or the management of established forbs. Species and cultivars are often selected based on the individual manager's cultivation practices. In tilled situations cover crops may include: bell beans (*Vicia faba*), field peas (*Pisum sativum*), vetch (*Vicia* spp.), clovers (*Trifolium* spp.), fescues (*Festuca* spp.), barley (*Hordeum vulgare*), and oats (*Avena sativa*). Under a non-till scenario a grower may choose clovers (*Trifolium* spp.), fescues (*Festuca* spp.), Blando brome (*Bromus mollis*), perennial ryegrass (*Lolium perenne*), bur clovers (*Medicago* spp.), trefoils (*Lotus* spp.), orchard grass (*Dactylis glomerata*), wildrye (*Elymus* spp.) and others. McGourty (1994) provides a thorough overview of cultivar selections and management for northern California. The inclusion of these plantings into an otherwise sterile production environment increases biological diversity thereby promoting cultural and pest management options.

Cover crops are recognized for providing beneficial aspects to soil fertility, stability and compaction (Nicholson and Richmond 1984; McGourty 1994). Likewise, they often serve as a nursery crop for beneficial organisms that otherwise would have to immigrate from adjacent sites. Proper cover crop selection can: 1) reduce the number of ice nucleating bacteria responsible for frost damage to crops; 2) reduce the costs of petro-chemical inputs into a production system; and 3) serve to manage plant vigor by adding a measured degree of competition into a production system (G. McGourty, pers. comm., Plant Science Advisor, UCCE, Mendocino County).

Though widely used in orchard and vineyard cropping systems, little is known about the impacts of cover crop selection and rodent populations or how cover crops should be managed in order to minimize rodent damage. This paper reviews the current literature and provides some recommendations from a managerial perspective.

## THE INFLUENCE OF COVER CROP MANAGEMENT ON RODENTS

### Pocket Gophers (*Geomyidae*)

Pocket gopher feeding impacts on agronomic crops are well documented (Fitch 1949; Foster and Stubbendieck 1980; Luce et al. 1981; Case 1989) and widely recognized by managers. Growers are acutely aware of the potential negative impacts from uncontrolled pocket gopher populations. However, the benefits realized from the inclusion of cover crops into their management systems far exceeds the potential threat of pocket gopher feeding damage.

Anecdotal information exists from individuals who have been experimenting with cover crop selections and rotations. Norton (pers. comm., UCCE Farm Advisor, Merced County) suggests that the use of clovers in apple and peach orchards has resulted in elevated pocket gopher populations precluding the continued use of this perennial cover crop. Bugg (pers. comm., Pest Management Specialist, UCD) has observed relatively high numbers of pocket gophers in perennial clovers as compared to systems using perennial grasses. These generalizations are pervasive among a number of people who have observed pocket gopher/cover crop interactions. Formal evaluations of pocket gopher response to cover crop selection is lacking. Managers are left to their own intuitive approaches to manage cover crop selections and pocket gopher population controls.

Loeb (1990) and Giusti (unpubl. data) reported that irrigation in alfalfa can increase pocket gopher fecundity by extending the breeding season and increasing litter frequency and sizes. Case (1989) provides a strategy to minimize pocket gopher damage to alfalfa. He suggests using cultivars with a fibrous root system rather than a

tap root to minimize feeding damage on overall field productivity. He argues fibrous cultivars can sustain higher levels of gopher feeding. From a managerial perspective, since cover crops are not managed as a cash crop, production is unimportant; therefore, the lower yields of fibrous cultivars are not a factor. It could be argued that a plant with a fibrous root system, could potentially lower carrying capacity for pocket gophers, provide beneficial soil and crop amendments, yet still be capable of tolerating high levels of pocket gopher damage.

Since the presence of pocket gophers is often first noticed through the detection of mounds it is important to select a cover crop that does not obscure a manager's ability to view burrowing activity. Short statured grasses would make visible detection relatively simple when compared to a dense, mat-forming cover crop such as a perennial legume. This scenario provides a cover crop of relatively low density and canopy height for burrow detection, and avoids fleshy rooted plants conducive to increased pocket gopher fecundity. Sheep fescue (*F. ovina* cul. *covar*) and hard fescue (*F. ovina* var. *duriuscula* cul. *durar*) are examples of low growing (3" to 6" canopy heights), fibrous species appropriate for this situation.

Management Implications

Since pocket gophers have the ability to cause catastrophic losses to perennial crops one should be extremely cautious when trying to manage cover crops as the only means of reducing pocket gopher populations. Pragmatic approaches to a cropping system should include the use of cover crops in combination with time-tested methods of pocket gopher controls. Cover crop selection and management should: 1) be viewed as a cultural approach to population manipulation not control; 2) ground covers should be selected on the basis of canopy height in order to allow early detection of mounds and burrowing activities; and 3) legumes should be viewed as having the greatest potential of causing increases in pocket gopher populations.

Voles (*Microtus*)

Unlike pocket gophers, the damage and presence of voles is readily visible. Giusti (1985) provides a review of the relationship of voles and herbaceous cover. It is well documented that voles respond positively to the onset of winter precipitation in California and the subsequent emergence of green forage. Throughout northern California where vineyard and orchard crops are often grown in close proximity to oak woodlands, the presence of voles in adjacent fields is common. The potential threat from voles immigrating into a vineyard or orchard from an adjacent grassy field is a likely scenario between the months November through March. Cover crops that provide adequate cover and food should be viewed as being attractive to voles. In addition, cover crops that are allowed to come into contact with the production commodity should be viewed as being at risk of damage from vole feeding.

Nicholson and Richmond (1984) discuss the relative abundance between native bunch grasses, legumes and their relative palatability to *Microtus pennsylvanicus* and *M. pinetorum*. They recognize that forage selection may have more of an effect on a surface-dwelling species, *M. pennsylvanicus*, than on a fossorial species like *M. pinetorum*. Throughout California the dominant species is *M. californicus*. This species should be considered a surface-dwelling type similar to *M. pennsylvanicus*. In their paper, Nicholson and Richmond (1984) discuss the importance of "heavy grass cover ... dense vegetation, low light penetration and high moisture levels" as beneficial to increasing vole populations. These criteria should also be viewed equally important when dealing with the California species. They conclude that, "vulnerability for this small prey species (from predation) can be increased by selecting orchard ground-covers with an erect, bunch-type growth habit that does not mat or lodge." This statement should be considered accurate for any cropping systems having potential vole damage in California.

Thompson (1965) evaluated the palatability of 30 plant species to voles. Generally, he demonstrated that legumes were the most preferred followed by grasses of European origin. He further determined that native grasses and sedges were of intermediate preference while boreal and bog plants were least favored. Rhodes et al. (1983) found similar preferences with legumes being the most attractive forage to voles. In his work he further demonstrated that crown vetch (*Coronilla varia*) and creeping myrtle (*Vinca minor*) were highly unacceptable. Though these particular species may not be suitable for cropping systems in the west it does point to the need for further investigative types of selections.

Coley et al. (1995) suggest that certain endophytic fungi associated with fescue may play a role in reducing vole fecundity. The impacts of endophytes on domestic animals is well documented (Fribourg and others 1991). However, as pointed out by Coley, the focus has been on trying to eliminate endophytic fungi from grazing systems while ignoring the potential benefits they could provide to both invertebrate and vertebrate pest control. He suggests endophytic-positive ($E^+$) grasses could provide a potential mechanism for reducing rodent populations in specific sites. If further tests prove this hypothesis accurate, this could provide an environmentally safe alternative to conventional field rodent control techniques, particularly in regions having to deal with associated threatened and endangered species. Growers now have the ability to select $E^+$or $E^-$ grasses when planting pastures. From a managerial perspective $E^+$ grasses should be evaluated as part of a cover crop regime to determine their potential to reduce herbivore populations.

Edge et al. (1995) demonstrated a 50% reduction in gray-tailed voles (*M. canicaudus*) after mowing and haying in perennial alfalfa fields. They reported that populations declined due to mortality and an increase in dispersal. They warned of the species ability to rapidly repopulate an area and that mowing by itself should be viewed as having only limited and short-term impacts. Their paper demonstrates the importance of habitat disruption in managing vole populations.

Management Implications

Past control efforts for voles have concentrated on application of toxic baits in combination with complete removal of suitable habitat and forage. The work

described herein provides some managerial perspectives on cover crop management that may serve to constrain vole populations without having to completely remove all associated vegetation. Ground-cover selection based on the presence or absence of endophytic fungi, native grasses that tend to grow in an erect fashion, and prudent mowing and clean farming techniques directly beneath vines or trees could provide the necessary criteria to minimize vole damage while maintaining maximum cover crop benefits.

Ground Squirrels (*Spermophilous*)

The relationships between cover crop management and subsequent influence on ground squirrels is poorly understood. As a group, ground squirrels are widely recognized has having the ability to achieve very high populations levels in suitable habitats. The Belding ground squirrel (*S. beldingi*) is a serious pest in irrigated alfalfa fields of northeastern California. The California ground squirrel (*S. beechyi*) is widely considered a major pest of many orchard crops in the Central Valley under a variety of management systems. Current practices rely on the application of toxic baits and fumigants in combination with cultural manipulations to minimize squirrel damage.

From a managerial point of view, it could be inferred that $E^+$ endophytic plants would have similar impacts on ground squirrels similar to other herbivores, but this has not been tested. It could also be inferred that short-statured grasses may be less conducive to ground squirrel populations than perennial legumes, but similarly this too has not been evaluated. Simply said, very little quantitative evaluations have taken place regarding the response of ground squirrels to cover crop selection and management.

Cable and Timm (1987) demonstrated how manipulation of grass through deferred grazing had significant impacts on black-tailed prairie dogs (*Cynomys ludovicianus*). They showed deferred grazing reduced reinfestation of prairie dog sites following population reduction through vegetation manipulations. Their work suggests that some species of ground squirrels may be susceptible to vegetation manipulations.

Management Implications

Damage by ground squirrels may be exacerbated by fields with squirrels next to a highly attractive crop. Because of the squirrel's ability to feed at great distances from its burrow, it may be difficult to minimize damage in any particular field utilizing cover crops if an adjacent field is providing optimum forage and cover. This said, it would be prudent to select a cover crop that has the least potential for attracting ground squirrels. Such crops may include native grasses including: California brome (*Bromus carinatus*), Blue wildrye (*Elymus glaucus*) and Meadow barley (*H. brachyantherum*). Annual grasses, as well as other species that require minimum irrigation requirements, provide minimal forage and cover qualities should also be evaluated to better identify important managerial procedures. Mowing, baiting, fumigation and habitat manipulations should all be considered as a means of reducing squirrel populations and should not be eliminated in light of the general lack of knowledge regarding cover crop management and these species.

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