GROUND SQUIRREL BURROW DESTRUCTION: CONTROL IMPLICATIONS

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ABSTRACT: Rapid reinvasion of low-density sites by dispersing ground squirrels often results in short-term benefits from otherwise effective population control methods. Existing vacant burrow systems appear to play an important role in facilitating the local population recovery. The potential of destroying the ground squirrel burrow entrances to reduce site reinvasion, following population removal, was tested. Under the conditions of the tests, deep ripping resulted in >85% reduction in burrow reinvasion by California and Belding ground squirrels. Studies are still in progress to evaluate the consistency of the results and include long-term effects and cost information. The inclusion of this technique into the management of crops rather than the management of one pest species alone is discussed.

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INTRODUCTION

Ground squirrels are major pests of agriculture and represent a public health concern because of their involvement in the epidemiology of plague. Ground squirrel damage control in California relies primarily on population reduction through the use of toxic baits, fumigation, shooting, and trapping (Salmon and Schmidt 1984). Depending on the conditions, these methods meet with varying degrees of success (Salmon and Lickliter 1983). The benefit can be short term because through immigration and reproduction, population recovery can be very rapid. When a large source of recolonization exists, population size has even been reported to be higher 20 days after the removal of the resident squirrels (Alsager 1972). Recolonization rates for various squirrel species were reviewed by Stroud (1982).

The removal of the resident ground squirrels from an area opens up a valuable resource to the surviving and immigrating squirrels: the extensive burrow systems dug, maintained, and expanded upon by generations of squirrels. Few studies have documented quantitatively the importance of the existing burrows in relation to site recolonization. Salmon et al. (1987) reported that following complete population removal, 21 of 24 existing burrow sites were recolonized while only 2 new sites were dug in the recolonization of 7 acres by California ground squirrels (Spermophilus beecheyi). It appears likely that the presence of vacant burrows plays an important role in facilitating site recolonization and rapid local population recovery because dispersing ground squirrels move into existing burrows rather than digging new ones. The possibility of destroying burrows to retard recolonization had been mentioned in the literature as early as 1946 (Linsdale 1946).

The goal of our research for the last few years has been to identify methods of manipulating burrow systems that would effectively retard recolonization of a site following population removal. The methods tested were in the most part relevant to existing farming practices. The detailed studies will be published in the future, and the following is an overview of the work both completed and in progress.

OVERVIEW OF GROUND SQUIRREL BURROW DESTRUCTION

Our first test showed that shallow disturbance and filling of burrow entrances after population removal were ineffective in reducing site recolonization by California ground squirrels (Salmon et al. 1987). These results led to the testing of a more thorough burrow entrance destruction method. A test of ripping California ground squirrel burrow entrances with a tractor equipped with a ripping blade (18 in depth) resulted in 9 times fewer burrow systems recolonized when compared to nonripped entrances (Fig. 1). In this test, other nonripped burrows were available nearby. Squirrel reinvasion of the area was monitored for 13 months (Salmon, unpubl. data). Similar results were obtained with the Belding ground squirrel S. beldingi (Salmon, unpubl. data) (Fig. 2). Another method, rototilling the burrow entrances after population removal, didn't reduce recolonization enough to be useful for squirrel control purposes.

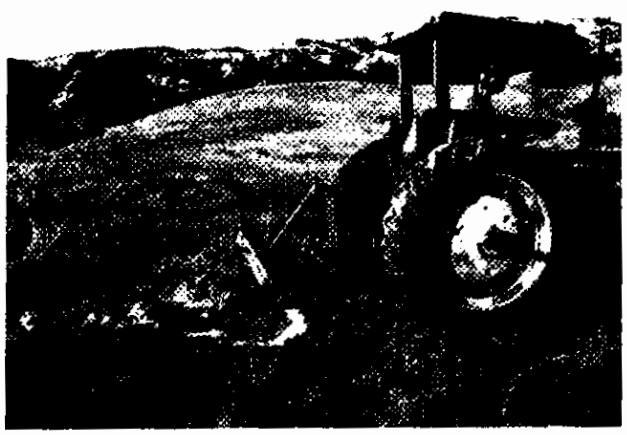

Figure 1. Ripping of squirrel burrows near Livermore, CA. This ripper consists of three 18-in blades. (Note powdered chalk used to delineate the burrow system.)

The next stage of the research tested the effect of ripping over relatively large areas. Initially, the results were disappointing. After 6 months, recolonization rates in the ripped blocks were only 15% lower than in the control blocks. The constant increase in activity through the 6-month period suggested squirrel emergence from hibernation rather than recolonization, and indicated poor squirrel control efficacy prior to ripping. These results are important because they show that destroying the burrow entrances without effectively

controlling California ground squirrels significantly reduces the effectiveness of the treatment.

Figure 2. Tractor with a single 18-in ripping blade.

In 1989, the previous year's study was replicated. Special attention was given to the timing and monitoring of the ground squirrel population removal prior to ripping the site. Control efficacy was estimated close to 100%. In February 1990, while squirrels were numerous and active all around the experimental site, there was still little squirrel activity on the study plot. Monitoring of burrow reinvasion continues.

INTEGRATED PEST MANAGEMENT

This discussion is based on the following understanding of integrated pest management (IPM): "...in its simplest form it is accepted as being a control strategy in which a variety of biological, chemical, and cultural measures are combined to give stable long-term pest control...fundamental is a sound understanding of the ecological basis of the pest problem" (Burn et al. 1987).

The relevance of IPM to ground squirrel control has often been considered but in practice progress has been relatively slow, especially as related to cultural control methods. In light of the preceding discussion on ground squirrel dispersal and the importance of existing burrow systems to squirrels, we believe it important to integrate squirrel damage control into the management of the crop, rather than manage the pest species alone. This approach still requires ground squirrel population removal, but long-term control efficacy is likely enhanced by manipulating ground squirrel habitat, making it less favorable for invading squirrels. This method utilizes current farming practices (e.g., ripping) but the timing of both ground squirrel control and the habitat manipulation is a key factor to obtain optimal benefit. While ripping is limited to certain situations, it could often be applied during preplanting operations and adjacent to crops where squirrels are present.

CONCLUSION

The results of the two studies described above demonstrate that burrow entrance destruction has the potential to reduce site recolonization by California and Belding ground squirrels following population removal. This approach could result in reduced rodenticide use because the length of time between applications would be increased. We intend to pursue these studies, expanding them to include longer term effects and cost information. If our findings are consistent with the results of our initial work, this technique should be part of an integrated pest management program and incorporated into overall management of crops.

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