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A Novel Strategy for Pocket Gopher Control

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Abstract. Current techniques for the control of pocket gophers use traps, fumigants or toxic baits. Trapping and fumigation are labor intensive and seldom effective in giving more than short-term relief. Toxic baiting usually uses baits that are rapidly degraded and although the resident gopher may be killed the burrow system is frequently reoccupied very rapidly and little long-term control is achieved. The use of persistent baits that remain toxic and acceptable to the gophers for an extended period may result in more effective long-term control.

INTRODUCTION

Pocket gophers are major pests of agriculture and forests throughout extensive areas of the United States of America. Three species dominate, the Northern Pocket Gopher (Thomomys talpoides) in the Pacific Northwest, the Valley Pocket Gopher (Thomomys bottae) in the Southwest and the Plains Pocket Gopher (Geomys bursarius) east of the Rocky Mountains.

The damage attributed to gophers is as diverse as the range of habitats they occupy. They destroy the root systems of fruit trees in orchards throughout the Northwest, they are a major cause of reforestation failures in the western states (Barnes 1973, Tunberg et al 1984), and are serious pests of agriculture, particularly sprinkler-irrigated alfalfa, where more than 440 gophers per ha have been recorded (Tickes 1983).

Significant reductions in yield of fruit and alfalfa occur and harvest machinery may suffer extensive damage from hitting gopher mounds. Irrigation systems, underground power and telephone cables and home gardens may also be destroyed by gophers (Stewart and Baumgartner 1978).

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Barnes (1973) reported that up to 67% of planted ponderosa pine seedlings may be destroyed while Ronco (1970) found 4 - 54% annual mortality in spruce seedlings and 3 - 30% mortality on contorta pine. Gophers may cause the complete failure of plantations (Barnes 1973, 1974, Canutt 1970, Capp 1976, Crouch 1971).

The burrow system created by a single gopher may cover half a hectare with burrows ranging from just below the surface to over 60 cm deep. Gophers are normally solitary except during the breeding season but will rapidly invade an unoccupied system (Stewart and Baumgartner 1978, Tunberg et al 1984). One other characteristic of note is that gophers store food in nests or other enlarged chambers (Stewart and Baumgartner 1978) and these food caches may be eaten by other gophers that invade the burrow system following the death or disappearance of the original occupant (Tunberg et al 1984).

CONTROL STRATEGIES

Many different strategies have been used in attempts to control the various species of pocket gophers. However, many of the methods are only effective in specific locations or conditions and no method gives consistent long term control (Tunberg et al 1984). Mortality of at least 75% is necessary to give any degree of long term relief (Barnes 1973) and 90% mortality has been suggested as necessary before a significant long-term reduction in damage is obtained (Capp 1976).

Cultural Practices and Exclusion

In limited areas where intensive maintenance is possible exclusion may be feasible to protect a valuable crop. A barrier at least 60 cm into the ground is necessary. Alternatively, crop rotation may be of some benefit by creating periodic unfavorable conditions but this too is a method of very limited applicability (Case 1983, Tickes 1983,). A band of cereal grain grown as a perimeter to an alfalfa field may be effective as a barrier if the enclosed field is cleared of all resident gophers. Flood irrigation may also be effective in some areas but has very limited applicability (Case 1983).

Trapping

Trapping is only effective with very low population densities due to the number of traps needed to catch all the gophers present and the return visits inherently necessary in a trapping program. It is extremely slow and time consuming although it is a widely used technique in forest operations (Barnes 1973), due largely to a lack of more efficient methods able to be used in cut-over areas. It is often not cost effective either (Tickes 1983).

Fumigation

Several fumigants are registered for use in gopher control. However, they are not effective in sandy or dry soils where the gas may rapidly dissipate (Case 1983, Stewart and Baumgartner 1978,) and, again, in all but low density populations the time and cost of using this control method is prohibitive. Smoke cartridges may be useful in indicating the extent of a particular burrow system however.

Toxic Baiting

The use of toxic baits for the control of pocket gophers has been practiced for many years but often with only inconsistent or limited success. Various formulations of baits containing strychnine have been the most widely used with zinc phosphide and first generation anticoagulants used to a more limited extent, either on loose grain or in pellets (Case 1983, Canutt 1970, Handley 1978, Marsh 1987, Tickes 1983,). Wheat, milo and oats are the major ingredients in most baits although just about every type of grain has been used either alone or in various mixtures. Some products are not registered for use in all states and others have various restrictions on their use such as a limit to hand application only. (Case 1983, Marsh 1987, Tickes 1983,).

With the use of acute toxicants the rapid onset of symptoms may cause poison shyness or tolerance may develop reducing the level of control achieved (Anthony et al 1984, Case 1983, Tickes 1983, Tickes et al 1982,). Further, not all gophers potentially exposed to the poison may be able to find sufficient bait to kill them (Tickes 1983). The bait may be mixed or covered with soil and go unnoticed as the runway is extended or filled during foraging (Tickes 1983). In areas of high humidity and excessive moisture treated grain baits often become damp, caked or mouldy which reduces their palatability (Barnes et al 1985, Marsh and Pleese 1960, Ray 1978). Conversely, bait spilled on the ground during application can create a hazard to ground feeding birds (Case 1983).

Baits are usually applied by hand, using probes or other means of getting the bait into the burrow, or through the use of mechanical burrow builders. Hand baiting is much faster than trapping but is still too slow to allow adequate treatment of extensive areas (Barnes 1973), particularly if several return visits are necessary to maintain an acceptable level of control. The burrow builder is substantially faster allowing large areas to be treated but its use may be restricted by soil conditions, topography and obstructions (Barnes 1973) and some skill is required to operate the equipment well (Tickes 1983). Dry soil will crumble preventing the formation of a satisfactory burrow and obstructions such as rocks and stumps may limit the accessible area, a common situation in reforestation programs. Further, the artificial burrows may expedite reinvasion by gophers or other rodents and may even expand the infested area so that the end result may be worse than the original situation.

The selection of the toxicant to use with a burrow builder is also limited. The first generation anticoagulants are not considered to be suitable for use in small pellets or as loose grain at the current toxin loadings as the gopher must eat too much over too great a distance to receive a lethal dose (Marsh 1987). This may be overcome, however, by formulating the baits at a higher strength thereby reducing the amount of bait necessary to be lethal. There has been interest in using anticoagulants for some time, however, due to the numerous desirable characteristics inherent with their use. The availability of the second generation materials was thought to overcome some of the problems found with earlier materials, especially the relatively large quantity of bait that had to be consumed over several days. Unfortunately, these compounds have not been markedly more successful when used experimentally in field trials than many of the older products (Kaukeinen and Rampaud 1986, Poche' 1986).

These various shortcomings in the techniques available to control pocket gophers have been recognized for a long time and numerous studies have been made to overcome them. The use of larger, more durable baits is an approach that has received a lot of attention. Cardboard or plastic tubes filled with various grain and paraffin mixtures and several different toxicants have been evaluated in numerous studies as a way to get a larger amount of toxicant to a gopher at a single site. These studies gave some indication of the

potential of this strategy of concentrating a large amount of toxicant in one bait (Tunberg et al 1984). Solid paraffin and grain blocks of various sizes have also been evaluated on numerous occasions, particularly by Howard and Marsh (Lee 1986, Marsh 1987, Tunberg et al 1984). These paraffined baits are more moisture resistant than conventional baits and so remain acceptable for some time. Consequently, they contain ample bait for multiple feedings and they remain fresh so that invading animals may also find and eat enough bait to receive a lethal dose (Lee 1986). Tunberg et al (1984) had up to 4 gophers killed by a single bait over a 40 day period. Thus, not only may the initial level of control be improved but the use of persistent baits may also help control gophers in systems missed when the bait was applied, or new invaders from untreated areas (Lee 1986), a problem frequently identified (Capp 1976, Couch and Frank 1979, Tunberg et al 1984). Marsh (1987) found that because of the delayed death when anticoagulants were used in durable baits the gopher often ate all the bait and so none was left for others. Attempts to slow down the feeding so that some bait remained were largely unsuccessful. Wood chips, sand, pea gravel, hard plastic or salt were used in the baits but were discontinued as some animals would refuse the baits. Placing baits in plastic bags was not successful either as some gophers ejected the bags from their burrows although they were well accepted in laboratory trials (Lee 1986). Lee (1986) found that pocket gophers readily accepted the paraffin baits and mortalities up to 100% were achieved in her trials. Almost invariably the gophers died underground too thus reducing the risk of secondary poisoning.

If acute toxicants are used the blocks can be small as little bait is needed to be lethal to any gopher eating the bait. However, if anticoagulants are used the baits need to be large as the gopher will eat a substantial amount of the bait before dying. Baits of about 100 g are large enough to kill the resident gopher and still have some bait left for later invaders. It is also apparent that gophers are able to move baits of this size to their food caches (Tunberg et al 1984) which may increase the probability of them being found and fed upon subsequently.

Following on from this extensive background of research J. T. EATON & COMPANY. INC. have formulated a bait containing the anticoagulant diphacinone and shaped it for ease of placement in gopher burrows. It weighs about 110 g and therefore is large enough to kill the resident gopher and still remain in sufficient quantity to be lethal to a subsequent invader.

In our own studies an initial pen trial with four juvenile northern pocket gophers indicated that they would readily accept the paraffin blocks. All four died within seven days. Although alternative food was continuously available the gophers ate over 90% of the bait offered indicating that the baits were well accepted.

In a field study in early June, a time not usually suitable for treatment as there is often little apparent sign of gopher activity, substantial population reductions occurred. Two orchard blocks totalling about 6 ha were treated. These areas would have been trapped otherwise as the soil was unsuitable for the use of burrow builders. As the orchard was regularly irrigated, only mounds 2 or 3 days old were apparent and many other gophers may have been active but not recorded as their burrow systems were not located. At each identified active system only one half of a 100 g paraffin bait block was placed in each end of the main burrow after it was opened with a shovel. The burrow was then closed. Two weeks later each plot was reassessed by recording the number of active mounds. Every burrow system identified as active at the reassessment was then rebaited and assessed again a further two weeks later.

Gross reductions of 50% and 69% in the number of obviously active mounds were recorded following the first bait application and overall reductions of 77% and 88% were recorded after the second application.

Due to the effects of regular irrigation it is most likely that numerous complete systems were not detected and therefore not baited but could have been recorded in the post poisoning assessments. Thus the assessed mortality is likely to be substantially less than occurred in the gophers which were actually exposed to the baits. Further, the treated areas were relatively small with large perimeters and migration of gophers from untreated adjacent areas probably occurred. In normal control operations these areas would also have been treated.

The bait applications were done by totally inexperienced orchard workers who readily accepted the technique but who could have missed some systems. Thus, it is reasonable to assume that applications during the more preferred poisoning seasons of spring and fall with experienced applicators would yield significantly better results. Further, results from comparable adjacent areas which were heavily trapped yielded population reductions of only about 20%.

In retrospect, substantially more bait should have been placed in each opened burrow. Whereas only a total of 100 g was placed in each identified system the use of a whole block placed in each exposed end of the burrow may have resulted in even better control by ensuring that more bait was available for gophers occupying the burrow following the death of the original occupant.

Later trials have indicated that these baits withstand weathering for over two months while remaining acceptable and toxic.

The use of a new product,"EATON'S ANSWER for the Control of Pocket Gophers", was effective in controlling gophers in a situation where other techniques were ineffective. The product has been improved from the baits used in the initial trials

and now provides a persistent bait which will be acceptable and effective against gophers that invade the system sometime after the original occupant has died.

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