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AN EVALUATION OF FENCING TO EXCLUDE POCKET GOPHERS FROM EXPERIMENTAL PLOTS

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ABSTRACT: We evaluated the ability of underground fencing to exclude pocket gophers (*Thomomys bottae*) from experimental plots planted with alfalfa. Fencing extending 61 cm below and 91 cm aboveground, with a 15.2-cm lip bent 90 degrees inward at the bottom, did not prevent marked and unmarked gophers from escaping, invading, or moving among six adjacent plots. Complete underground screening, in combination with gopher control, may be the only technique which ensures the complete exclusion of gophers from experimental and ornamental plots.

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INTRODUCTION

Underground fencing sometimes is recommended as a permanent solution to prevent pocket gopher (*Thomomys* sp.) damage to small vegetable or flower plots (Dixon 1922, Storer 1949, Alsager 1970, Case 1973, Clark 1975, Stair 1980, Horstman and Gunson 1983, Timm et al. 1984, Turner et al. 1984). Fencing extending 41 to 61 cm below ground and 30 cm aboveground has in the past been considered adequate. As part of a study to quantify damage done by the Botta pocket gopher (*T. bottae*) to alfalfa (*Medicago sativa*), we had an opportunity to evaluate barrier fencing as a method of preventing gopher movements.

MATERIAL AND METHODS

Pocket gopher enclosure tests were conducted on the University of California, Davis campus, Yolo County, California. Soils were deep, well-drained loams with an effective rooting depth >150 cm (Huntington et al. 1981). Six adjacent 12.2 x 24.4-cm plots were planted with alfalfa in September 1980. During December 1980, these plots were individually enclosed with 1.27-cm mesh galvanized aviary netting which extended 61 cm below and 91 cm aboveground. Stakes supported the aboveground portion, which was designed to retard gophers from escaping or gophers and other small mammals including jackrabbits (*Lepus californicus*) and voles (*Microtus californicus*) from entering the plots. The very bottom portion of the underground fence was bent 90 degrees inward, forming a 15.2-cm lip to prevent gophers from escaping. Plots were side-to-side and shared a common fence along their longer borders. The underground lip between plots was increased to 30.4 cm, 15.2 cm in both directions, to prevent interplot movements. All plots were inspected at regular intervals and no gopher mounds were detected from the time of planting, construction of the enclosures, and introduction of the animals. Therefore, we considered all plots free of gophers at the beginning of the study.

In September 1981, two individually marked (toe-clipped) pocket gophers were introduced into each test plot. Plots were monitored monthly and new marked animals were added periodically to keep mounding activity relatively constant

(Table 1). Only adult females were used, and they were kept for a minimum of 25 days prior to release to ensure none were pregnant. During this study, any gopher activity (mounds) within 15 m of the fences prompted trapping and removal of those individuals. Two years after the initial introductions (November 1983), all gophers in the plots were removed by trapping.

Table 1. Sex and age composition of Botta pocket gophers (*Thomomys bottae*) trapped from alfalfa plot enclosures in November 1983. Seventeen, 10, 15, 14, 11, and 17 marked female adult gophers were released in plots 1 through 6, respectively, between September 1981 and June 1983.

Gophers	Plot No.					
	1	2	3	4	5	6
Adult female (marked)	2	2	1	2	4	1
Adult female (unmarked)	1	4	2	6	3	2
Adult male	0	1	2	1	2	1
Juvenile female	1	1	3	3	2	5
Juvenile male	0	3	4	3	4	3
Total captures	4	11	12	15	15	12

RESULTS AND DISCUSSION

During the 25 months of the test, 84 animals were released into the six plots. We recorded only three escapes (marked gophers trapped outside the plots). The burrow of one escaped gopher was traced back to a 30-cm tear in the

fence 5 cm beneath the surface. The fence had been cut with a hoe during weed control. We immediately inspected the entire fence to a depth of 13 cm and made repairs as needed. Several other tears were found, but no gopher tunnels were associated with them. From this point on, great care was taken not to damage the fence.

Only 12 of the remaining 81 marked gophers introduced were recovered at the end of the test. Four were recaptured in their home plot, three were found in plots adjacent to their original plot, and it was impossible to positively identify the home plot of 5 of the 12 recaptures as the marking system used led to marking duplication in some plots. The 69 missing marked gophers presumably died or emigrated. In addition, a total of 57 unmarked gophers was trapped in the six plots (Table 1). Although the demographic profile of these trapped gophers could be explained by a single invading male breeding with marked females in both 1981 and 1982, we suspect some of these animals were the result of independent invasions.

In this study, neither a 61-cm deep fence (facing gophers outside the plot) nor a 61-cm deep fence with a 15.2-cm, 90-degree lip (facing gophers on the inside of the plot and in both directions between plots) seemed to prevent gopher movements into, out of, or among plots. The actual route of gopher movement among and into the plots is unknown. Travel aboveground appeared unlikely because the fence was in good condition (no rips or gaps) and the height (91 cm) should have been an adequate barrier to this fossorial mammal. While the entire underground fence could not be examined, several portions were excavated at the end of the study and they appeared in good condition. The likely explanation for failure of the fence is that gophers burrowed beneath it. Even if gophers went through the fence, it failed as a practical tool since more care was taken than would be in an operational program. Once one gopher circumvents the fence, that burrow might then be used by other gophers moving in either direction (Howard and Childs 1959). Little is known about deep burrows, and Howard and Childs (1959) speculated that some deep tunnels may be more or less common property. Whereas Gettinger (1984) found *T. bottae* nest chambers at an average depth of 38.3 cm, Miller (1957) reported some burrows extending below 200 cm. A similar species, *T. mazama*, burrows to depths > 188 cm (Tunberg et al. 1984). Fitch and Bentley (1949) constructed enclosures of 1.27-cm mesh hardware cloth extending 76 cm deep with a 15-cm lip extending both inward and outward at the bottom. Their fence extended 79 cm aboveground. They stocked these enclosures with *T. bottae* and speculated that some animals may have escaped, but they did not report whether marked animals were captured outside or unmarked gophers captured inside the enclosures. Keith (1961) described a similar fence to exclude *T. talpoides*, but it was used in conjunction with a poisoning and trapping program, and the effects of fencing versus population removal could not be separated.

If a permanent solution to gopher damage is desired, an underground fence extending below the deepest recorded burrow system (200 cm) or to the hardpan (or bedrock) might be effective but this remains to be tested. An alternative would be to use complete underground screening whenever possible, taking care not to tear any hole in the fencing. While expensive and labor intensive, gardeners have indicated to us that this is effective when the area to protect is relatively small. As with any exclusion program, reducing

gopher densities in adjacent areas by trapping or poisoning should reduce the potential for invasion.

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