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Efficacy of Bromadiolone and Strychnine Baits for Control
of the Northern Pocket Gopher

By

Daniel Sullivan and Monty Sullins

ABSTRACT

Efficacy of two bromadiolone whole wheat baits (50 ppm and 100 ppm AI) and one strychnine whole barley bait (500 ppm AI) was tested for control of the northern pocket gopher. Bait was applied under field conditions using a tractor-drawn burrow builder. The bromadiolone baits averaged 8.5 and 17.4 percent reduction in activity for the 50 ppm and 100 ppm baits, respectively. The 500 ppm strychnine bait averaged 52.8 percent reduction in pocket gopher activity. Bait acceptance test showed 90 percent and 67 percent removal of the strychnine and bromadiolone test baits, respectively.

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INTRODUCTION

The northern pocket gopher (*Thomomys talpoides*) frequently occupies agricultural lands including alfalfa haylands, pasture areas and irrigation ditch banks. The burrowing and foraging activities of pocket gophers results in reduction of hay and forage yields, decreased longevity of alfalfa stands, damage to harvest equipment, reduced harvest efficiency and loss and inefficient use of irrigation water.

Control of pest pocket gopher population can be accomplished by cultural methods such as crop rotation and flood irrigation. These methods are not economical or practical in many farm management systems. Trapping is also effective but not practical for large acreage infestations. Use of toxicants on baits applied by hand or mechanical applicators is often used for pocket gopher control but use of currently registered products often result in inconsistent and unsatisfactory control. Continued investigation for improvement of current control methods and development of new alternatives is needed.

Bromadiolone is an anticoagulant rodenticide that is registered by the U.S. Environmental Protection Agency for control of commensal rodents. This rodenticide may be effective for control of field rodent species (Marsh 1977; Sullivan 1982a, 1982b, 1983) including pocket gophers (Marsh 1977) and investigations are needed to make this determination.

STUDY OBJECTIVE

The objective of this study was to determine the efficacy of two concentrations of bromadiolone bait (50 ppm and 100 ppm) for population reduction of the northern pocket gopher.

STUDY AREA

Eight study plots (7 treatment, 1 control) were selected from alfalfa and grass hayfields occupied by pocket gophers near Lewistown, Fergus County, Montana. The study plots were located on long, narrow hayfields between a highway and a railroad track. These barriers were expected to retard immigration of gophers on to the study plots during the study period. The alfalfa was breaking dormancy at the beginning of the study (4/6/87) and had grown to a height of about 12 inches by the study's completion (5/8/87). A snow fall at the end of March provided good soil moisture on the study area resulting in excellent conditions for burrow builder operations. Temperatures during the study period ranged from nighttime lows of 25°F to daytime highs of 80°F.

METHODS

Two concentrations of bromadiolone bait were tested (50 ppm and 100 ppm). The bromadiolone was formulated on whole wheat using Rhoplex as the adhesive to facilitate feeding of the bait through a mechanical applicator. A commercial pocket gopher bait (500 ppm strychnine on whole barley) was used as an efficacy standard.

Bait was applied using a tractor-drawn mechanical burrow builder (Blackwelders, Rio Vista, CA). Burrows were constructed at 20 foot intervals. Both formulations of bromadiolone baits were applied at a 2 pound per acre rate. Approximately 1.8 g of bait was deposited at 1.3 m intervals. The strychnine bait was applied using the same burrow interval and burrow builder calibration which applied the barley bait at approximately 1.7 pounds per acre. Where necessary a 150 foot buffer zone between plots of different formulations or at plot ends was established to retard immigration of pocket gophers on to the study plots. The buffer area was treated with the same bait as the plot it bordered.

Efficacy was measured using active burrow counts to determine reduction in pocket gopher activity. A minimum of 20 active gopher burrows were located per study plot. Pocket gopher activity separated by a distance of 40 or more feet was considered a separate burrow system. Burrow systems were opened and any burrow not closed by gopher activity after 48 hours was considered inactive.

At 7 and 21 days posttreatment the burrow systems marked active during the pretreatment census on each study plot were opened. Each burrow was checked at 24 and 48 hours after opening. Any opened burrow that remained open was considered inactive as a result of the bait treatment.

A control plot was monitored for pocket gopher activity in the same manner as the treatment plots. No bait was applied to the control plot.

Percent reduction in activity was calculated using the following formula (Henderson and Tilton 1955).

$$\text{Percent Reduction in Active Burrows} = 1 - \frac{\text{Holes Closed Posttreatment (Treatment Plot)}}{\text{Holes Closed Pretreatment (Treatment Plot)}} \times \frac{\text{Holes Closed Pretreatment (Control Plot)}}{\text{Holes Closed Posttreatment (Control Plot)}} \times 100$$

Bait acceptance tests were conducted concurrently with the efficacy trails. The tests were conducted in the same area but not within the boundaries of the efficacy test plots. For each test 5 g of bait was placed in a pocket gopher burrow through a hole made by a sharpened 1/2 inch diameter metal probe. The probe hole was carefully closed after bait placement and the placement site marked. After 7 days the placement site was excavated. The soil was screened and the presence or absence of bait was noted. Twenty individual bait acceptance tests were conducted with the 100 ppm bromadiolone bait and the strychnine barley bait. Bait acceptance tests were limited to one per burrow system.

RESULTS AND DISCUSSION

The bait acceptance tests resulted in 67 percent of the bromadiolone bait placements being removed from their original location. Ninety percent of the strychnine barley bait placements had been removed. The fate of the bait, whether eaten by the gophers or cached, is unknown. The condition of the bait not removed showed swelling and softening of the kernels and sprouting of some of the wheat kernels after 7 days underground.

Percent reduction in pocket gopher activity averaged 8.5 percent for the 50 ppm bromadiolone bait, 17.4 percent for the 100 ppm bromadiolone bait and 52.8 percent for the strychnine bait 21 days posttreatment (Table 1). None of these results for the baits tested is acceptable for long term pocket gopher control.

In Montana, strychnine grain baits are the only rodenticide products registered for pocket gopher control that are economical to apply to large acreages. Field trials by MDA and antedotal observations from producers indicate that efficacy achieved with strychnine baits is unpredictable and variable even under what appear to be similar application conditions. An alternative rodenticide should give better results than currently available strychnine rodenticides or at least do as well. The bromadiolone baits tested in this study clearly do not meet this requirement using the rate of application and active ingredient concentrations tested.

The reasons for the generally poor results using currently registered pocket gopher rodenticides and the bromadiolone test baits used in this study are unclear. Several variables likely affect efficacy of pocket gopher baits but they are difficult to assess under field conditions.

Grains are eaten by pocket gophers in laboratory confinement and preference may be demonstrated for specific types and varieties of grain. Under field conditions grain baits may compete poorly with the natural and accustomed forage items of the pocket gopher diet. Field bait acceptance tests indicate baits are picked up by gophers, but if they are eaten or cached is unknown. Under

TABLE 1. Percent Reduction in Activity in Pocket Gophers
Using Bromadiolone and Strychnine Baits.

	<u>Plot No.</u>	<u>Date</u> 4/23/87*	<u>Average</u>	<u>Date</u> 5/8/87*	<u>Average</u>
Bromadiolone (50 ppm)	1	11.0	14.3	+11.4	8.5
Bromadiolone (50 ppm)	2	17.6		28.3	
Bromadiolone (100 ppm)	3	32.1	23.1	32.6	17.4
Bromadiolone (100 ppm)	4	14.1		1.4	
Strychnine	5	36.8	20.7	35.0	52.8
Strychnine	6	35.1		76.4	
Strychnine	7	26.9		47.0	
Control	8	3.7		23.0	

* 4/23/87 and 5/8/87 are 7 and 21 days posttreatment,
respectively.

the moist conditions of pocket gopher burrows, grain bait may degrade within 2 to 3 weeks. For acceptable efficacy bait must be consumed shortly after application or formulated in a manner that will preserve its acceptability and toxicity until eaten by the gopher if the bait is cached.

To enhance bait acceptance bait must be placed where the gophers are most likely to encounter it. The placement, therefore, must be underground, out of observation of the researcher. Even when careful attention is made to perform a quality bait application, either by hand or machine, there are still questions about the availability of the bait to the gopher. Under operational control programs performed by producers, where attention to application technique is often less rigorous than when conducted by professional researchers, the question of bait availability is an even greater concern.

In this study it is unknown if the rate of bait application and active ingredient concentration of the bromadiolone baits was sufficient to give adequate efficacy even if bait acceptance was good. In a pocket gopher system that occupied 2000 square feet approximately 42 g of bait would have been placed within the area of the gopher's system. If the gopher consumed 10 percent of the available 100 ppm bait it would ingest about 0.42 mg of bromadiolone or 3.5 mg/kg for a 120 g body weight. In a burrow system occupying 1000 square feet a gopher consuming 10 percent of the available bait would ingest 0.21 mg bromadiolone or 1.75 mg/kg for a 120 g body weight. Marsh (1977) fed Thomomys bottae 50 ppm bromadiolone bait for one day with no deaths. Gophers fed for two days resulted in death to 6 of 7 gophers tested. Average bait consumption was 12.2 g and average bromadiolone intake was 5.29 mg/kg.

RECOMMENDATION FOR FURTHER STUDY

To help reduce the variables in this study it would be useful to determine the minimum lethal dose of bromadiolone to Thomomys talpoides and other pocket gopher species. This would determine if sufficient bromadiolone was available within a gopher's burrow system to cause mortality if consumed. If the availability of the active ingredient was insufficient trials can be conducted with bait of higher active ingredient concentrations. If it appears sufficient bromadiolone was available work can be concentrated on improving bait formulation to increase bait acceptance and to improve application techniques.

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LITERATURE CITED

- Marsh, R. E., 1977. Bromadiolone, a new anticoagulant rodenticide. EEPO Bull. 7(2):495-502.
- Henderson, C.F. and W. Tilton, 1955. Tests with acaricides against the brown mite. J Econ Entom. 48(2):157-161.
- Sullivan, D., 1983. Field evaluation of bromadiolone treated bait for control of the Columbian ground squirrel. Montana Department of Agriculture, Technical Report 83-1. 12 pp.
- Sullivan, D., 1982a. Determination of an effective single lethal dose for bromadiolone to Columbian ground squirrels. Montana Department of Agriculture, Technical Report 82-4. 11 pp.
- Sullivan, D., 1982b. Bait stations as a means of rodenticide presentation to control Columbian ground squirrels. Montana Department of Agriculture, Technical Report 82-3. 26 pp.