

FIELD EFFICACY EVALUATION OF DIPHACINONE PARAFFIN BAIT BLOCKS AND STRYCHNINE OAT GROATS FOR CONTROL OF FOREST POCKET GOPHERS (*Thomomys* spp.)

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ABSTRACT: The effectiveness of bait and the effectiveness of operational baiting were both evaluated for controlling forest pocket gophers (*Thomomys* spp.) with strychnine oat groat bait and diphacinone paraffin block bait. Radio-telemetry monitoring and recovery of pocket gophers showed that control of individual pocket gophers 1 month after baiting was 72% for strychnine bait and 62% for diphacinone bait. Reduction in pocket gopher activity from operational baiting was based on censusing activity in sample plots. After 1 month the reduction in activity was 61% for strychnine oats and 36% for diphacinone blocks. Bait blocks implanted with radio transmitters were extensively moved and fed on by pocket gophers. Pocket gopher activity was not significantly reduced by either treatment 6 months or 1 year after baiting.

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INTRODUCTION

Pocket gophers continue to be a problem on National Forests and state and private lands, causing reforestation losses on hundreds of thousands of acres. Few control materials or methods for controlling forest pocket gopher damage are available. Reductions in pocket gopher abundance can be achieved for short time periods in some areas with strychnine grain bait (J. Evans and D. L. Campbell unpublished report, Denver Wildlife Research Center, 24 pp. 1989, Evans et al. 1990). Repeated treatments may be required within 1 year because of rapid reinvasion of burrow systems. Identification of active burrow systems for treatment is difficult during spring planting periods because gophers have not yet begun making fresh mounds. As a consequence, new tree seedlings may be heavily damaged even when rodenticide treatments are in use because the appropriate baiting sites cannot be easily recognized. In some sites in southern Oregon the application of strychnine treated oat bait was ineffective for reducing pocket gopher activity in reforestation units that had been previously baited (D.L. Campbell, J. Evans, and R. M. Engeman, unpublished report, Denver Wildlife Research Center, 6 pp. 1989).

Possible advantages of using toxicants in long-lasting, moisture-proof formulations have been considered for some time (Marsh and Plesse 1960, Tunberg et al. 1984) because rapid reinvasion of treated areas by these rodents is one of the key management difficulties. Earlier studies have examined such materials for control of pocket gophers in agricultural areas using paraffin bait formulations of diphacinone (Marsh 1987, Sullivan and Sullins 1987).

The present study was conducted to evaluate paraffin bait blocks containing 0.005% diphacinone conditionally registered by the Environmental Protection Agency (EPA) for J. T. Eaton and Co., Inc. in June 1989 (EPA Registration No. 56-57). Use of this material was compared with treatments using a 0.50% strychnine alkaloid oat groat bait formulation manufactured by ORCO, Inc., (EPA Registration No. 9691-8-5042 (OATS)) which has been widely used in pocket gopher control. Use of tradenames for identification purposes in this paper does not indicate any endorsement by the

authors, the U. S. Department of Agriculture, or cooperating agencies. Radio-telemetry and monitoring of opened burrows and mound building by gophers were used in evaluations of pocket gopher activity for 1 year after baiting. The study was conducted on the Rogue River National Forest in southwestern Oregon with the assistance of Forest Service(FS) personnel.

METHODS AND MATERIALS

Study Area

Twelve reforestation units, (T36S, R3E & R4E WM), mainly shelterwood units in Cascade-mixed-conifer habitat with the overstory removed, were selected because of a history of pocket gopher damage to several species of conifers. Elevation of the study units was approximately 1,600m and ranged in size from about 4.8 ha to 14 ha. Slopes were gentle to moderate with soil and moisture conditions adequate for production of high quality large timber that existed adjacent to the units. Snow cover was normal in the area from November through March.

Telemetry and Bait Application

Bait treatments were applied to units selected randomly from those available. Four of these units also were chosen randomly to be studied with radio-telemetry. Transmitters weighing about 7g and numbered leg bands were attached to 13 pocket gophers (weighing about 72g) on each unit (except 1 unit which had transmitters on 14 pocket gophers) about a week prior to baiting in October 1990. Animals were monitored before baiting to assure activity, and for up to 2 months after baiting to monitor changes in activity and to recover carcasses and transmitters. Animals were live-trapped or kill-trapped to recover transmitters.

Pencil-type radio transmitters weighing about 6g were inserted into 31 paraffin diphacinone bait blocks with an average weight of 129g. The bait blocks, measuring (10.5cm x 4.5cm x 3cm) fit tightly into most burrows. Soil was placed behind the blocks to prevent entry of light. The movement and consumption of bait blocks was monitored and blocks or block fragments were recovered at the transmitter location.

Table 1. Pocket gopher activity following treatments with four bait formulations in October 1990. Formulations were untreated paraffin bait blocks, paraffin bait blocks containing 0.005% diphacinone, untreated oat groats, and oat groats containing 0.50% strychnine alkaloid.

Block	Unit	Size (ha)	Bait (%)	Per Ha (kg)	Reduction in Activity		
					1 Mo (%)	6 Mo (%)	1 Yr (%)
1	*Vino 1, 2, 3	10.0	0.0 Diph	5.69	16.0	0.0	0.0
	Brandy 8	10.8	0.005 Diph	4.96	32.0	0.0	8.0
	Bar W Rye 8	14.0	0.0 Stry	0.14	29.0	16.0	0.0
	Bar W Rye 7	8.8	0.50 Stry	0.19	65.0	22.0	4.0
2	High Wap 1C	7.6	0.0 Diph	3.63	8.0	16.0	0.0
	High Wap 5	11.2	0.005 Diph	4.09	32.0	12.0	4.0
	High Wap 1A	12.0	0.0 Stry	0.08	16.0	4.0	12.0
	Biberstadt 2	13.6	0.50 Stry	0.16	76.0	20.0	4.0
3	Will Bar 9	5.2	0.0 Diph	7.15	24.0	0.0	0.0
	W Rye Pro 1	8.0	0.005 Diph	14.60	44.0	8.0	0.0
	Sec 33 South	4.8	0.0 Stry	0.25	4.0	0.0	0.0
	Sec 33 North	8.0	0.50 Stry	0.13	44.0	8.0	4.0

*Radio-telemetry was used for study of pocket gophers and bait blocks in this block of units.

Estimates of percent reductions in pocket gopher activity based on plugged burrows were generally lower than those based on telemetry data. This may have been caused by rapid reinvasion of sample plots despite the treatment of the entire units, or may reflect limitations in this method of assessing activity. Observations of radio-equipped gophers showed that some did not plug holes within 48 hours. In other plots pocket gophers with radio transmitters were found dead, but their opened burrows were plugged by other gophers.

Determination of over-winter pocket gopher activity about 6 months after baiting and immediately after snow melt, showed considerable activity on most units. Soil-casts were found on 69% (208 of 300) of the sample plots. Soil-casts were constructed in snow in 68% (51 of 75) of the test plots in strychnine baited units, and in 62.7% (47 of 75) of the test plots in the diphacinone baited units. Of the units baited with untreated oats, 74.7% (56 of 75) had soil-casts; 72% (54 of 75) of those baited with untreated blocks contained casts. The greatest reduction in activity was 22.0% on Barley West Rye 7—a unit baited with strychnine oat groats (Table 1). Few fresh mounds were made after snow melt by pocket gophers. For the 48 hour check during this period, only 3% (9 of 300) of the plots on all units had fresh mounds. During the same period, pocket gophers plugged opened burrows on 73% (218 of 300) of the plots. The fall activity check 12 months after baiting showed that nearly all plots (88 - 100%) were occupied on all units regardless of bait treatment applied (Table 1).

Comparison of Treatments

Statistical comparison of pocket gopher activity associated with treatments showed significant reductions one month after baiting on plots treated with strychnine bait (61.33%) and diphacinone bait (36.00%) compared with untreated controls (Table 2).

In the spring, about 6 months after baiting, gopher activity was no longer significantly different among bait treatments (Table 2). At this period, the greatest mean reduction in activity was 16.00% for the strychnine baited units. Analysis for re-occupancy of plots showed that differences from pretreatment ($P < 0.05$). Ninety-five percent confidence intervals were calculated for mean percent re-occupancy and only the units treated with 0.50% strychnine bait produced confidence intervals that excluded 100%.

In October 1991, about 12 months after baiting, there were no significant differences among bait treatments (Table 2). There was no measurable reduction in activity caused by baiting the previous fall. Plot activity was 96% for both the 0.50% strychnine and 0.0% strychnine treated units. Plot activity for diphacinone bait units was also 96% and the control was 100%.

Table 2. Reduction of pocket gopher activity on sample plots in twelve baited forest units, at 1 month, 6 months, and 12 months after treatment.

Treatment ^a (%)	Mean Reduction in Activity (%) ^b		
	1 Mo. (%)	6 Mo. (%)	12 Mo. (%)
0.0 Diphacinone	16.00 a	5.33 a	0.00 a
0.005 Diphacinone	36.00 b	6.67 a	4.00 a
0.0 Strychnine	16.22 a	6.76 a	4.05 a
0.50 Strychnine	61.33 c	16.00 a	4.00 a

^aEach treatment was applied to 3 different forest units in October, 1990.

^bMeans with no letter in common are significantly different at $P < 0.05$.