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THE EFFECTIVENESS OF STRYCHINIE LACED ALFALFA ON POCKET GOPHER ACTIVITY IN DIAMOND VALLEY, NEVADA

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ABSTRACT: The Townsend pocket gopher, (Thomomys townsendi), poses a serious economic threat to alfalfa production in Diamond Valley, Nevada. Many control methods have been practiced with only limited or seasonal success. Application of strychnine-treated alfalfa hay has been an effective control method; however, the relationship between strychnine concentration and pocket gopher kill has not been examined. This study was conducted to evaluate the effectiveness of three concentrations (0.5%, 1.0% and 1.7%) of strychnine-treated alfalfa hay baits. The three strychnine levels and untreated control were replicated three times on twelve 0.8-ha (2.0-ac) plots. Plots were located on a 6-year-old stand of sprinkler-irrigated alfalfa. Pocket gopher activity, (mound count census method), was monitored pre- and post-treatment to estimate bait effectiveness. Data were evaluated by regression analysis of variance. Average percent changes in gopher activity were +24%, -40%, -78% and -69% for treatments 0%, 0.5%, 1.0% and 1.7%, respectively. There was a significant ($P<0.01$) negative effect of strychnine concentration on pocket gopher activity.

INTRODUCTION

The Townsend pocket gopher (Thomomys townsendi) poses an economic threat to alfalfa production in Diamond Valley, Nevada. This area has been under intensive production for only a short time. Alfalfa production potential was not realized until the early 1970s. At that time pocket gopher infestations were small and localized. Most producers were not extremely concerned with their presence. As production expanded more sprinkler irrigation systems were installed. These systems provided ideal pocket gopher habitat. Today approximately 25% of the established alfalfa cropland is heavily infested with pocket gophers.

Local producers have used various techniques to control pocket gophers. Mechanical bait applicators, fumigation, habitat elimination, trapping and cultural methods have given some success at certain times of year and dependent on degree of infestation. Successful control requires endurance, patience and cooperative effort by everyone.

The technique that has proven most effective in late spring and summer has been poisoning with strychnine-laced alfalfa hay. However, the relationship between strychnine concentration and bait effectiveness has not been examined. Producers have complained that bait concentrations of 0.5% or less have not been consistently effective.

The purpose of this study was to evaluate the effectiveness of different concentrations of strychnine-laced alfalfa hay bait in reducing pocket gopher populations.

STUDY AREA

The study was conducted in Diamond Valley, approximately 13 km north of Eureka, Nevada. Mean annual precipitation is 22 cm. Mean annual temperature is 8 degrees C. The soils on the study site are well-drained silt loam and fine sandy loam. Elevation is approximately 1800 m.

High quality, dairy-type alfalfa hay is produced in this central Nevada valley. Alfalfa croplands occupy about 11,300 ha. This area supplies California dairies with a significant portion of all Nevada hay exported to that state.

Study plots were located on a 6-year-old stand of sprinkler-irrigated (wheel line) alfalfa. This land was heavily infested with pocket gophers.

METHODS AND MATERIALS

The study area was surveyed and divided into twelve 0.8-ha (2.0-ac) square plots. Each plot was assigned one of three strychnine alfalfa bait concentrations (0.5%, 1.0% and 1.7%) or designated as an untreated control. There were three plots per treatment. Figure 1 illustrates the plot design.

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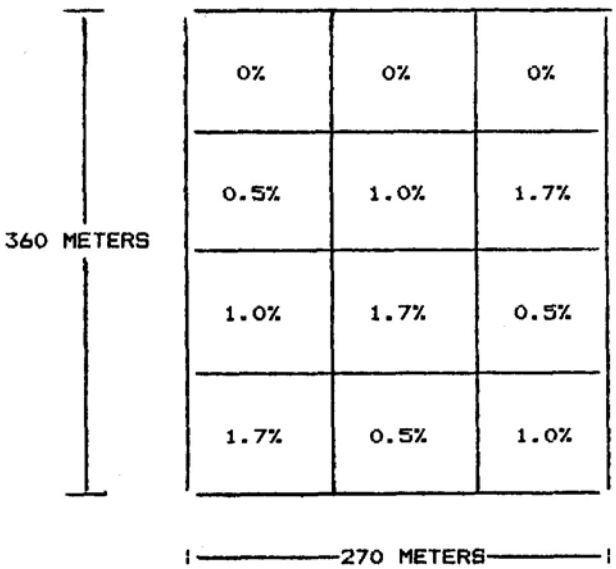

Figure 1. Distribution of strychnine alfalfa hay baits on 0.8 ha test plots.

Pocket gopher activity was monitored in each plot using a pocket gopher mound count census method (Howard 1961, Richens 1965, Reid and Hanson 1966, and Anthony and Barnes 1983). Each new mound or series of new mounds in close proximity was recorded. After being recorded, mounds were kicked over so they would not be recorded again on subsequent counts. On April 29, 1985, all the mounds in the study area were knocked down with a spring tooth harrow. Counts of new mounds were conducted on April 30, May 1, 2, 3, 5 and 7, 1985. Bait was applied on May 2, 1985. No bait was applied in the 0% strychnine treatment plots. Bait formulas for the 0.5%, 1.0% and 1.7% strychnine alfalfa hay baits are in Table 1. Alfalfa hay was manually broken up and made loose prior to mixing with the strychnine. No attempt was made to separate alfalfa leaves or stems.

Table 1. Formulas for 0.5%, 1.0% and 1.7% strychnine alfalfa hay baits.

Ingredients	Strychnine concentration (%) 0.5	1.0	1.7
Water (ounces)	32	32	32
High quality alfalfa hay (pounds)	23	23	17
5.1% strychnine alkaloid (ounces)	50	100	150

A five-man team applied bait. Approximately 15 g of bait was hand placed into an opened pocket gopher burrow. Bait was placed as far into the burrow as possible. If the burrow forked, bait was placed in both directions. After bait placement the burrow opening was plugged with a clump of sod or dirt clod and covered with soil to exclude light. Three hundred eighty-four locations were baited. Application took 2 hours (10 man-hours).

Percent changes in the average numbers of new mounds produced pretreatment to posttreatment were computed for each plot and treatment. Substantial changes, if any, in the 0% (control) treatment were removed from the other treatments using the following formula:

$$\text{Adjusted average posttreatment mound count} = \frac{\text{Average postreatment mound count} \times \text{Average pretreatment control mound count}}{\text{Average posttreatment control mound count}}$$

Adjusted average posttreatment mound counts were then used to compute adjusted percent changes in number of mounds produced in 0.5%, 1.0% and 1.7% strychnine treatments.

The effect of strychnine concentration on pocket gopher activity was examined by regression analysis of variance (Steel and Torrie 1980).

RESULTS AND DISCUSSION

Average pretreatment and posttreatment pocket gopher mound counts and adjusted average posttreatment mound counts are in Table 2. Percent changes in pocket gopher mounds produced are in Table 3.

Table 2. Average numbers of pocket gopher mounds before and after application of strychnine alfalfa hay baits.

Treatment (%) strychnine		Replication 1	2	3	Average mound count	Adjusted average mound count
0	Pretrmt.	9.0	14.0	15.5	12.8	----
	Postrmt.	18.7	10.0	19.0	15.9	0
0.5	Pretrmt.	12.0	14.0	46.5	24.2	----
	Postrmt.	11.0	8.3	24.3	14.6	11.7
1.0	Pretrmt.	15.0	21.5	44.5	27.0	----
	Postrmt.	2.7	8.3	7.0	6.0	4.8
1.7	Pretrmt.	8.5	17.0	27.5	17.7	----
	Postrmt.	3.7	3.0	9.7	5.4	4.3

Table 3. Percent change in numbers of pocket gopher mounds produced after application of strychnine alfalfa hay baits.

Treatment % strychnine	Replication (%) 1	2	3	Average change (%)	Adjusted average change (%)
0 (Control)	107	-29	23	24	0
0.5	-8	-40	-48	-40	-51
1.0	-82	-61	-84	-78	-82
1.7	-56	-82	-65	-69	-75

The 24% increase in the number of mounds produced in the OX strychnine (control) treatment we believe is due at least in part to a bias in our census procedure; that is, the use of 48-hour count intervals rather than 24-hour intervals for the second and third posttreatment counts. This would probably cause these counts to be higher than what they would have been with the shorter time interval. Natural variation in pocket gopher activity may have also contributed to the increase.

The adjusted 51% decrease in pocket gopher activity for the 0.5% strychnine bait may be due to sublethal ingestion and bait shyness. Tickes (1982) reported 0.5% strychnine-laced oats achieved negligible control and possibly gophers were receiving sublethal doses of toxicant. Legally, 0.5% is the strongest strychnine concentration Nevada label recommendations allow.

The 1.0% and 1.7% strychnine baits gave better control than the 0.5% bait. It cannot be determined if there is a real difference between these two baits since the variation within the replications for each treatment is large (Table 3).

A significant negative effect ($P<0.01$, $r^2 = 59\%$) was found between strychnine concentration and the number of new pocket gopher mounds produced after bait application. This relationship is best described by the following equation:

$$\text{Percent change in pocket gopher mounds} = -148 + \frac{177}{(\text{Strychnine concentration} + 1)}$$

As strychnine concentration increases, the number of mounds produced decreases but at a lessening rate (see Figure 2). From this test it appears growers' complaints about 0.5% strychnine baits are warranted. The adjusted reduction of 51% for the 0.5% strychnine bait makes baiting hardly worthwhile. Further testing is needed to determine the best concentration of strychnine for consistently effective control.

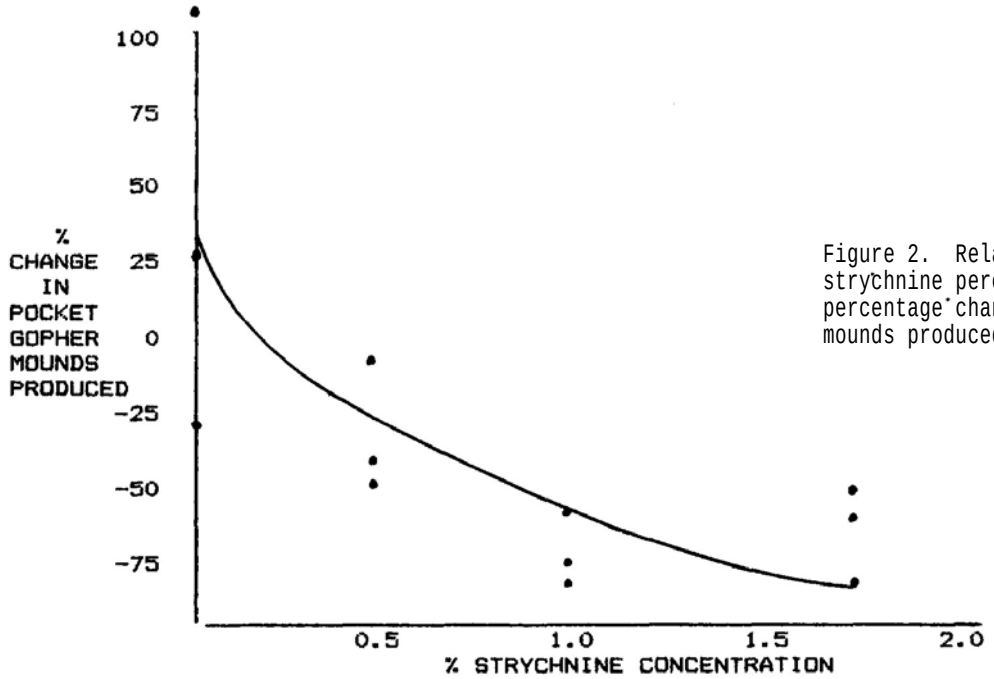

Figure 2. Relationship between strychnine percentage in bait and percentage change in pocket gopher mounds produced after treatment.

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