Montana Department of Agriculture
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Field Evaluation of Chlorophacinone Treated Bait for Management of Ground Squirrels in Montana.

By

Daniel Sullivan and Monty Sullins

ABSTRACT

Field trials were conducted to determine the efficacy of multiple applications (two applications at a 48 hour interval) of chlorophacinone treated oat groats on Columbian and Richardson ground squirrels in Montana. The bait, 100 ppm chlorophacinone, was spotted baited by hand. Percent reduction in squirrel activity averaged 97.3% and 88.7% for the Richardson and Columbian ground squirrel, respectively.

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INTRODUCTION

The loss of effective and economical field rodenticides for use on ground squirrels (*Spermophilus spp.*) in Montana has occurred in recent years. In 1986, the U.S. Environmental Protection Agency (EPA) denied Montana's request for continuance of a Section 18 (FIFRA) for use of Compound 1080 treated baits on the Columbian ground squirrel (*S. columbianus*). In 1988, EPA issued a temporary cancellation for the above ground use of strychnine rodenticides which is currently still in effect.

Zinc phosphide baits are the only rodenticides registered in Montana that are economical for use on ground squirrels occupying larger acreages. Efficacy evaluations of zinc phosphide baits (Sullins and Sullivan, 1990) resulted in generally inadequate and widely variable efficacy. Results obtained by agricultural producers under operational conditions have been similar. Use of zinc phosphide baits for control of ground squirrels by the agricultural community has been low.

Chlorophacinone baits are registered for control of voles (*Microtus spp.*), pocket gophers (*Thomomys spp.* and *Geomys spp.*) and ground squirrels (*Spermophilus spp.*) in many western states, including Montana. Chlorophacinone baits are most commonly formulated at active ingredient concentrations of 50 ppm (0.005%). Application of chlorophacinone baits is by use of bait stations or multiple (3 to 4) broadcast applications for voles and ground squirrels and in burrow placements for pocket gophers. When applied for ground squirrel control, these methods of chlorophacinone bait application are effective but can not be economically used over large acreages because of the cost of labor and materials.

Studies using two applications of chlorophacinone baits have been conducted (Sullivan and Sullins, 1986). The studies, using 25 ppm and 50 ppm baits, gave results not judged to be acceptable for effective ground squirrel control. Results of the studies did indicate that an increase in chlorophacinone concentration might give acceptable efficacy.

STUDY OBJECTIVE

The objective of this study was to determine the efficacy of two applications of 100 ppm (0.01%) chlorophacinone bait for control of Richardson (*S. richarsonii*) and Columbian ground squirrels.

STUDY AREA

Six study plots (4 treatment, 2 control) were selected from dryland alfalfa fields (post harvest) and pastures occupied by ground squirrels in Park County and Flathead County, Montana. Pasture plots had been grazed but no livestock were present during the study.

Temperatures during the study period (7/10/90 - 8/2/90) averaged about 50°F for low temperatures and ranged from 80°F to 90°F for the high temperatures. No measurable precipitation fell during or immediately after bait application on the study plots.

METHODS

Chlorophacinone bait formulated at a concentration of 100 ppm (0.01%) was tested. The bait carrier was unrolled, dehulled oats. The bait was colored with a dyed blue.

The bait was applied by hand using calibrated dippers which contained 9 grams of bait. One dipper of bait was scattered on bare ground near each active ground squirrel burrow on the study plot. A second application was applied in a similar manner 48 hours later. The test for each ground squirrel species was replicated once. The control plots received no bait application.

Bait acceptance by the ground squirrels was tested prior to bait application at a nearby site typical of the general area. Five grams of untreated oats were placed at 25 locations. Oat consumption was checked over a two day period. Consumption of oats on 80 percent of the bait spots within two days was judged adequate to apply the toxic bait.

Efficacy was measured by using visual counts to determine reduction in squirrel activity. Visual counts consisted of counting all visible squirrels on the study plots by making three counts using binoculars at five minute intervals each day for three consecutive days, pretreatment and posttreatment. Pretreatment counts were made immediately before treatment. Posttreatment counts were made 7 and 14 days posttreatment. If there was no significant difference in visual counts on the control plots pre and posttreatment, the control plot counts were not used to calculate reduction in activity on the treatment plots. Reduction in activity was calculated using one of the following formulas.

$$\text{Percent Reduction in Activity} = 1 - \frac{\text{No. Squirrels Counted Posttreatment (Treated Plot)} \times \text{No. Squirrels Counted Pretreatment (Control Plot)}}{\text{No. Squirrels Counted Pretreatment (Treated Plot)} \times \text{No. Squirrels Counted Posttreatment (Control Plot)}} \times 100$$

$$\text{Percent Reduction in Activity} = \frac{\text{Pretreatment Count (Treated Plot)} - \text{Posttreatment Count (Treated Plot)}}{\text{Pretreatment Count (Treated Plot)}} \times 100$$

Searches for target and nontarget carcasses were conducted throughout the posttreatment period. The number of carcasses found was recorded.

RESULTS AND DISCUSSION

The results of the bait acceptance tests showed good bait acceptance by the ground squirrels. The Richardson ground squirrels generally consumed most of the acceptance bait within one day. The Columbian ground squirrels had consumed most of the acceptance bait after two days.

Consumption of the test bait generally mirrored that seen for the acceptance bait. On the Richardson ground squirrel plots, virtually no test bait was found the day after application. The Columbian ground squirrels did not consume the test bait as readily as the Richardson ground squirrels. About half the test bait remained on Columbian plot 4 while most of the test bait remained on the Columbian plot 5 one day after application. Two days after application little test bait could be found on plot 4. On plot 5, consumption of the test bait was beginning but the majority of the test bait still remained. Although bait remained on Columbian plot 5, the schedule for the second bait application was maintained.

Percent reduction in activity on the Richardson ground squirrel plots averaged 97.3 percent 14 days posttreatment (Table 1). Percent reduction in activity on the Columbian ground squirrel plots averaged 88.7 percent 14 days posttreatment (Table 1).

Eight ground squirrel carcasses and one moribund squirrel were observed one week posttreatment on Columbian plot 4. Three additional squirrel carcasses were found on Columbian plot 4 at the end of the second week posttreatment. On Columbian plot 5, one moribund squirrel was observed at the end of the first week posttreatment and one squirrel carcass was found the end of the second week posttreatment. A badger (*Taxidea taxus*) and badger diggings were observed on Columbian plot 5. Domestic dogs (*Canis familiaris*) and their tracks were also observed on the Columbian plot 5. The badger and dogs may have removed squirrel carcasses from plot 5. The badger was still active at the end of the study period and no dogs were reported to be sick by any of the landowners near the study plots. Only one squirrel carcass and one moribund squirrel was observed on the Richardson ground squirrel study plots. No nontarget deaths were observed.

Table 1. Percent Change in Ground Squirrel Activity Using 0.01% Chlorophacinone Baits.

Plot No	Species	Percent Change in Activity (Posttreatment) Day 7	Day 14	Ave. Day 14
1	Richardson	-98.4%	-97.5%	-97.3%
2	Richardson	-90.6%	-97.1%	
3 (Control)	Richardson	+1.1%	+20.8%	
4	Columbian	-76.9%	-87.1%	-88.7%
5	Columbian	-80.5%	-90.3%	
6 (Control)	Columbian	-6.9%	-5.4%	

These test were replicated only once. The observed difference in efficacy between the two species may not be real. However, the Columbian ground squirrel averages larger in weight than the Richardson which may result in this species being somewhat more tolerant to the rate of chlorophacinone application used in this study.

We believe that the use of multidose anticoagulant rodenticides may have an advantage over the use of acute rodenticides in certain situations. This is particularly true, we believe, when the acute rodenticide may have an aversive characteristic such as an aversive taste (zinc phosphide and strychnine) or quick onset of poison symptoms (strychnine). Either characteristic may result in the target rodent stopping consumption of the acute bait before obtaining a lethal dose. Prebaiting and timing of the application during periods when bait will be more readily consumed by the target rodent is recommended to increase bait acceptance. Use of acute baits where they must compete with more desirable vegetation or grains often results in poor control even when good application practices are followed.

Ground squirrels and other rodents do not display any taste aversion to multidose anticoagulants, including chlorophacinone. The onset of poisoning symptoms usually does not occur until 4 or more days after ingestion. Sullivan (1982) observed

ground squirrels displaying symptoms of anticoagulant poisoning continuing to feed on anticoagulant bait placed in bait stations.

This multidose characteristic will be an advantage over aversive acute baits when the rodenticide bait is not readily eaten by the target rodents. The rodents, after initial sampling, may reject further consumption of the acute bait. Because anticoagulant baits have no taste aversion or rapid onset of poison symptoms, the target rodents are likely to return to the any remaining bait to continue eating. The multidose anticoagulants are more toxic when consumed in several small doses than if the same dose is eaten all at once (Timm, 1983). A rodent may survive a single dose of a multidose anticoagulant but die from the same quantity eaten over several days.

The application technique used in this study is likely to present less secondary hazard to nontarget animals compared to conventional methods of ground squirrel control using anticoagulants. Ground squirrels have an unlimited supply of bait available to them when baits stations are used to dispense the bait. Squirrels continue to feed after eating sufficient bait to cause mortality. The less time between the last feeding and death the less time there is for the squirrel to metabolize and excrete the anticoagulant. Squirrels that consumed anticoagulant bait from bait stations may contain chemical residues significantly higher than under the conditions of this study where the bait supplied to the squirrels was limited.

Ground squirrels were observed to consume an average 197 g of 0.005% chlorophacinone bait in a four day period in laboratory trials (D. Sullivan, unpubl. data). This calculates to consumption of 9.80 mg of chlorophacinone. If, under field conditions, a squirrel ate a full dipper of 0.01% chlorophacinone bait at each application it would consume 18 g of bait or 1.8 mg of chlorophacinone. Assuming a squirrel in the field may eat only 25 percent of the amount of bait from a bait station as a squirrel in laboratory confinement, it would still consume 2.45 mg of chlorophacinone. This is 36% more than a squirrel eating two full dippers of the 0.01% bait. Because of the colonial nature of ground squirrels few squirrels probably have the opportunity to eat the entire contents of a dipper of bait. After the second application there is no additional bait available to add to the body residue load. There is time for the squirrel to metabolize and excrete a portion of the toxicant before death which further reduces the risk to scavengers that may consume poisoned carcasses.

Operational costs to use a 0.01% chlorophacinone bait will be higher than operational costs of zinc phosphide baits. This is because the chlorophacinone bait is applied twice and at nearly twice the rate of zinc phosphide (9 g per application vs 5 g). The labor of application, however, will be the same because prebaiting with a nontoxic bait prior to application of zinc phosphide bait is necessary to increase acceptance. The variable and generally low efficacy of zinc phosphide baits reported by Sullins and Sullivan (1990) and Baril (1980) may make a 0.01% chlorophacinone bait a better choice because of its higher efficacy, more consistent results and greater flexibility, even if more expensive.

RECOMMENDATIONS

The agricultural community affected by ground squirrel damage may wish to expand its rodenticide options by requesting the registrant to submit an application for a special local need registration (Section 24(c) of FIFRA) for a 0.01% chlorophacinone bait for use on ground squirrels in Montana.

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