EFFICACY OF 3 IN-BURROW TREATMENTS TO CONTROL BLACK-TAILED PRAIRIE DOGS

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Abstract: Management of prairie dog (*Cynomys ludovicianus*) movement by colony expansion or dispersal may involve the use of toxicants to reduce local populations. Hazards associated with the use of toxicants cause concern for non-target species. Applying the bait in-burrow should reduce the primary exposure of the toxicants to non-target wildlife. Some literature suggests prairie dogs will not consume bait when applied in the burrow. In this trial we compared efficacy of Rozol® (chlorophacinone), Kaput-D Prairie Dog Bait® (diphacinone), 2% zinc phosphide oats applied in-burrow and 2% zinc phosphide oats applied on the surface. Results are reported as change in prairie dog activity.

Key words: chlorophacinone, control, *Cynomys ludovicianus*, diphacinone, in-burrow, management, prairie dog, toxicant, zinc phosphide

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INTRODUCTION

Control of black-tailed prairie dogs (*Cynomys ludovicianus*) is controversial on the Great Plains. Prairie dogs have been controlled on rangeland for many years largely with the use of toxicants applied above ground (Witmer and Fagerstone 2003). Most control efforts occurred because of perceived competition between domestic livestock and prairie dogs for range forage (Forrest and Luchsinger 2006). Prairie dogs feed on many of the same grasses and forbs that livestock do (Hansen and Gold 1977, Van Dyne et al. 1983). Regardless of the debate surrounding the consideration of prairie dogs as a keystone species, many species are associated with the habitat they create (Kotliar 2000). Some groups are concerned about the long-term viability of prairie dog populations. Some counties or townships require eradication of any prairie dogs (Lee and Henderson 1988). This type of controversy has lead to scrutiny of all types of control, especially the use of toxicants. Although there are numerous control techniques for prairie dogs, many landowners are dissatisfied with their consistency of efficacy and ease of use.

Most of the literature on black-tailed prairie dog control using toxicants, report on efficacy when the product has been applied on the soil surface. Tietjen (1976) reported prairie dog activity was reduced significantly more when bait was applied on the surface compared to when bait was applied in the burrows. That report may have caused future researchers to discount in-burrow treatments. When toxicants are on the surface the product is more accessible to non-target species especially birds. Lee et al. (2005) reported success with an in-burrow toxicant to reduce burrow reopening by prairie dogs. This paper reports on the change in activity level of prairie dogs as

measured by three different techniques using three different toxicants, two of which are applied in-burrow.

In the absence of management programs, the area occupied by prairie dogs can increase dramatically. Dogs on one ranch in Kansas increased the area occupied by prairie from 105 ha in 2000 to 970 ha in 2006 (Lee unpublished). That type of increase causes concern from those landowners who do not appreciate prairie dogs and whom may be neighbors to those that do. Zinc phosphide (ZP) is the most commonly used toxicant for prairie dogs that is applied on the surface (Witmer and Fagerstone 2003). Concerns about efficacy, bait avoidance, extra labor involved with pre-baiting and the potential exposure to birds and other non-target wildlife to toxic bait cause managers to seek alternatives to zinc phosphide applied on the surface.

STUDY AREA

We conducted the study on 4 black-tailed prairie dog colonies in eastern Colorado during December 2006 to March 2007. The colonies varied in size from 4.8 to 12.6 ha. The colonies have been established for several years, but their exact age is unknown. Colonies were not randomly selected but picked due to size and proximity to each other but still isolated from other colonies. Each complete colony was treated to reduce problems with emigration or immigration by prairie dogs from other colonies. This study site had no other untreated prairie dog colonies within 6.4 km. All four treated sites were within a 1.8 km radius of each other and the closest any colony was to another was 0.8 km. We suspect no inter-colony movement occurred at this time of year.

The dominant vegetation was buffalograss (*Buchloe dactyoides*) and blue grama (*Bouteloua gracilis*) with few forbs present. The vegetation did not appear to differ significantly from the areas not colonized by prairie dogs. Archer et al. (1987) reported vegetation change occurs as time of occupation increases.

Annual precipitation in the region averages 39 cm with about 57 cm of snow. However this year an unusual weather event blanketed the area with more than 100 cm of snow for more than 90 days while the study was underway.

No cattle were present on the areas while the study was in progress but the areas had been grazed during the summer of 2006. Colorado Department of Agriculture reported no black-footed ferrets were present in the area so it was not surveyed for ferrets. Some avian species observed on the area during the study included horned lark (*Eremophila alpestris*), western meadowlark (*Sturnella neglecta*), mourning dove (*Zenaida macroura*), northern harrier (*Circus cyaneus*), and burrowing owl (*Athene cunicularia*). The only mammal observed on the site other than prairie dogs was a jackrabbit (*Lepus californicus*).

MATERIALS

The grain baits tested were: Kaput-D Prairie Dog Bait (0.0025% diphacinone), 54 g, Scimetrics, LTD Corp., Wellington, CO.; Rozol (0.05% chlorophacinone), 53 g, Liphatech, Inc., Milwaukee, WI.; ZP Rodent Bait AG (2% zinc phosphide), 4 g, Bell Laboratories, Madison, WI. Reference to products does not imply endorsement. Kaput-D and Rozol have the active ingredient applied on dyed wheat, however, Tietjen (1976) reported that prairie dogs did not consume wheat as well as other grains such as oats, barley or milo.

The anticoagulant baits (Kaput-D and Rozol) are vitamin-K antagonists that disrupt blood clotting mechanisms and induce capillary damage (Pelfrene 1991). Death results from hemorrhage and exposed animals may exhibit increasing weakness

prior to death. Zinc phosphide is a non-anticoagulant rodenticide and occurs as an inorganic compound whose toxicity results from liberation of phosphine gas from reaction of the active ingredient with water and acid in the stomach (Hygnstrom et al. 1994). Death can occur within a few hours of ingestion.

METHODS

All colonies were measured with a global positioning system (HP-L4 GPS unit, Corvallis Microtechnology, Corvallis, OR) to determine area of coverage, location and orientation. Three different census methods were utilized. A visual count with two scans using 7 x 35 power binoculars after a 15 minute acclimatization period was conducted within 1 to 4 hours post sunrise and a visual count index conducted within 1 to 4 hours prior to sunset were the direct census methods used to estimate prairie dog populations. A plugged burrow index with 50 burrows plugged per site and the reopened burrows counted 24 hours post plugging was used as an indirect census method (Tietjen and Matschke 1982). Both census methods were used before and after the baiting application period, with the visual count index taken before the plugged burrow index, on all treated plots. The pre-treatment census was taken 1 day prior to application of the bait. The post-treatment census was to be taken 21 days after application of the bait, but deep snow delayed the post-treatment census for 105 days. The weather conditions were described as normal for the first two weeks of the trial followed by an extended period of ice and snow that covered the colony to a depth of more than 91 cm for more than 90 days. This depth of snow kept the prairie dogs below ground for an extended period of time.

The test baits were applied by a qualified applicator licensed by the State of Colorado. Baits were applied the day following the pre-treatment census. Bait application was made to all active prairie dog burrows, which were identified by visual observation of burrow openings that were generally free of leaves, other debris or spider webs, and/or showed freshly turned earth, and/or had prairie dog feces nearby. One-quarter cup of bait was placed into each active burrow for the anticoagulant baits. Sites that were to be treated with 2% zinc phosphide were prebaited with one teaspoon of clean oats applied either in-burrow or on the surface near the burrow entrance corresponding with the treatment protocol. One day later, the zinc phosphide oats were applied either in-burrow or on the surface. Bait application was made by hand from an ATV. A flexible hose and funnel was used for in-burrow treatments. All bait treatments were applied only one time.

A methodical carcass search of the complete treated plots was conducted twice each day until day 19 when snow covered the sites and we were no longer able to travel to the sites. Search grids were established about 40 m apart and driven each day with the searcher looking out the driver's side window. Prairie dogs discovered on the surface were collected and removed to limit their availability to predators and scavengers. Carcass searches were conducted both in the morning (to reduce likelihood of scavenging by raptors) and in the afternoon (to reduce scavenging by nocturnal predators).

The census methods were intended to "index" the population, and allow for a comparison of the index measurements taken pre-treatment and post treatment. The change in these population indices on treated plots was calculated using the formula modified after Tietjen (1976):

$$\% \text{ change} = \frac{\text{Pre-treatment Census} - \text{Post-treatment Census}}{\text{Pre-treatment Census}} \times 100$$

RESULTS AND DISCUSSION

The US Environmental Protection Agency (EPA) has established a 70% minimum standard for efficacy (USEPA 1982). Not all treatments in this trial were effective at reducing prairie dog activity which could be considered as a measure of efficacy. The means of the percent reduction in activity ranged from 14 to 100% (Table 1).

A comparative analysis model has been used by the EPA to rank and compare potential primary and secondary risks to birds and mammals (USEPA 2004) (Table 2). Use of that model indicates a wide variance of risk among toxicants. As contentious wildlife managers we should strive to use products that are efficacious but also reduce risk to other wildlife in the environment. That model would suggest that either chlorophacinone or dipahacinone would pose less risk than zinc phosphide.

Table 1: Percent reduction of black-tailed prairie dog activity by applications of toxicants applied in-burrow and on the surface on variable-sized plots in eastern Colorado in 2006-2007.

Toxicant	Survey Technique		
	Visual observation (am)	Visual observation (pm)	Burrow plugging
Diphacinone (in-burrow)	100	100	93
Chlorophacinone (in-burrow)	100	100	100
Zinc phosphide (in-burrow)	21	16	14
Zinc phosphide (on surface)	50	49	45

Table 2: Comparative analysis model results for overall risk to birds and mammals. Tabulated values are weighted measures of effect (Modified from USEPA 2004).

Rodenticide	*mg ai/kg*	Primary risks Birds	Primary risks Mammals	Secondary risks Birds	Secondary risks Mammals	Summary Values
Brodifacoum	50	5.58	1.25	8.60	6.76	5.55
Bromoadiolone	50	0.10	0.71	3.03	4.40	2.06
Bromethalin	100	0.10	0.10	2.20	0.44	0.71
Chlorophacinone	50	0.07	0.08	0.03	7.62	1.99
Cholecalciferol	750	0.12	0.18	2.00	2.00	1.07
Difethialone	50	0.01	0.22	3.18	8.42	3.01
Diphacinone	50	0.01	0.22	3.18	8.42	2.96
Warfarin	250	0.04	0.83	1.72	1.32	0.98
Zinc phosphide	20,000	7.81	10.00	0.00	0.69	4.63

Zinc phosphide is the only product with a federal registration for use on bait. Such baits are classified as Restricted Use Products and applicators must obtain certification from the EPA prior to using such baits. Zinc phosphide is often recommended as the rodenticide of choice because it is fairly specific for rodents and there is no true secondary poisoning, except possibly in dogs and cats. Most animals that feed on rodents are unaffected because the zinc phosphide does not accumulate in the rodent's muscles or other tissues (Matschke et al. 1992). Johnson and Fagerstone (1994) reviewed the hazards of zinc phosphide to wildlife and concluded it showed few risks to nontarget wildlife when properly applied. Nationwide, there have been poisonings of all species of domestic livestock, dogs and cats but these are usually accidental exposures and are few in number. Many species of animals are subject to zinc phosphide poisoning, but avian species, specifically gallinaceous birds, are the most seriously affected (USEPA 2004). Prebaiting with untreated oats several days prior to application of zinc phosphide is required by the label and increases efficacy (Tietjen and Matschke 1982).

Anticoagulant rodenticides were first discovered in the 1940s and have since become the most widely used toxicants for commensal rodent control. Rodents poisoned with anticoagulants die from internal bleeding, the result of loss of the blood's clotting ability and damage to the capillaries. Prior to death, the animal exhibits increasing weakness due to blood loss, though appetite and body weight are not specifically affected. Because anticoagulant baits are slow in action (several days following the ingestion of a lethal dose), the target animal is unable to associate its illness with the bait eaten. Therefore, bait shyness does not occur. This delayed action also has a safety advantage because it provides time to administer the antidote (vitamin K1) to save pets, livestock, and people who may have accidentally ingested the bait. Chlorophacinone and diphacinone are similar in potency. Chlorophacinone and diphacinone may kill some rodents in a single feeding, but multiple feedings are needed to give adequate control of an entire population (Clark 1994, Hygnstrom et al. 1994).

The use of anticoagulants to manage prairie dogs has been investigated by other researchers (Mach et al. 2002, Sullins 1990). Such efforts have failed to obtain a federal registration for their use. Under authority of Federal Insecticide, Fungicide and Rodenticide Act, Section 24(c), several states have allowed use of anticoagulants as a Special Local Need registration. These labels require the products to be placed into the prairie dog burrow where the product is not accessible to other animals. With these compounds, feeding does not always have to be on consecutive days. When anticoagulants are eaten daily, however, death may occur as early as the third or fourth day. In-burrow baiting would seem to reduce hazards to most species of birds.

Availability of carcasses found on the soil surface may increase the risk to non-target predators or scavengers. In this trial, we only found four prairie dogs that had died on top of the ground. All were found in the 4.9 ha colony that had been treated with Kaput D prairie dog bait. A carcass was found on day 8, two on day 10 and one on day 12 of the trial. Some secondary hazards have been found on test animals that are fed carcasses of rodents killed with chlorophacinone or diphacinone (USEPA 2004).

This trial looked at different survey techniques to determine activity. Severson and Plumb (1998) reported that burrow plugging is not an adequate measure of prairie dog population densities and suggest

visual observations are more accurate. The percent reduction in prairie dog activity during this trial was similar regardless of the survey technique used (Table 1).

Most ranchers want 100% mortality, although it is difficult to obtain 100% mortality in a single treatment regardless of the product used. Because colonies frequently recover almost completely within 3 years after a single poisoning, retreatment until 100% mortality is achieved is often the goal (Collins et al. 1984, and Ada et al. 1990). Repeat treatments with zinc phosphide are not as successful as initial efforts (Andelt 2006). This trial showed reduction in activity close to 100% with a single application of either anticoagulant Rozol or Kaput-D Prairie Dog Bait applied in-burrow.

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