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Comparative Efficacy of Rodenticides for Prairie Dog Control

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ABSTRACT: Rangeland owners and managers control populations of black-tailed prairie dogs for many reasons, but chiefly to preserve rangeland value for raising livestock. Several control options are available, but toxic baits are likely to offer the most economical and effective control. Baits are currently available with zinc phosphide and anticoagulant active ingredients, which have different chemical and toxicological characteristics. Field trials indicate that users may experience variations in the efficacy of the different baits, and further investigation is needed to identify the factors that influence these variations.

KEY WORDS: anticoagulant, bait, black-tailed prairie dog, chlorophacinone, *Cynomys ludovicianus*, diphacinone, efficacy, prairie dog, rangeland, rodent control, rodenticides, zinc phosphide

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INTRODUCTION

Why is there a need to control populations of black-tailed prairie dogs (*Cynomys ludovicaianus*) on rangelands? Rangeland managers are motivated to control these rodent pests in order to preserve the land's capacity to support livestock (Derner et al. 2006) and the sale or lease value of the land. They also wish to reduce the potential damage to crops and equipment, to slow the expansion of the prairie dog colonies (Fagerstone et al. 2005), and reduce the possibility of disease outbreaks that can infect humans (New Mexico Dept. of Health 2008).

Many control options are available, including shooting, trap/relocation, habitat modification by exclusion or barrier, burrow destruction, and poisoning. When prairie dog control becomes necessary, the landowner or manager has several factors to consider when selecting among available control methods, with efficacy and total cost (including labor) being major considerations. The responsible manager is also concerned about how the control method will affect his livestock, land and water resources, neighbors, and wildlife species that share the land with livestock. In some instances, these "non-cost" considerations will drive the decision of which control method to use. For the commercial livestock producer, many of the available options will be considered too expensive, time-consuming, and inefficient to be useful. For example, barriers such as silt fencing or snow fencing were found to be ineffective in preventing the spread of prairie dog colonies (Merriman et al. 2004, Hygnstrom and Virchow 1994).

For most producers, toxic bait is likely to provide the most effective and economical control. Toxic baits for prairie dog control are pesticides that must be registered with the United States Environmental Protection Agency (USEPA). The USEPA has established a requirement that this type of rodenticide must demonstrate at least 70% control of the target pest (Schneider 1982). Every pesticide has specific label cautions, instructions, and restrictions that must be followed by the user.

The toxic baits that are currently available for prairie dog control contain either the acute toxicant zinc phosphide or one of the anticoagulants (chlorophacinone or diphacinone). These two types of active ingredient have different characteristics, which can have a significant influence on how well they work for their intended purpose. These differences include the potential hazard to nontarget wildlife. Baits containing zinc phosphide have high acute toxicity, while anticoagulant baits have relatively low acute toxicity (Erickson and Urban 2004); both chlorophacinone and diphacinone typically require multiple doses to be lethal to prairie dogs. Consistent with this toxicity profile, zinc phosphide baits have caused some large bird kills from primary exposure (where a nontarget directly ingests the bait) (ODA 2005). Toxicity from secondary exposure (where nontarget predators or scavengers are exposed to the toxicant via consumption of prey that ingested it) is more difficult to assess. The USEPA's risk assessment process has ranked rodenticides for their potential secondary hazard, which asserts that zinc phosphide baits have a low potential for secondary hazard to nontarget animals (Erickson and Urban 2004). Residues of anticoagulant rodenticides remain in the tissues of the primary consumers for days or weeks following ingestion, and USEPA's assessment shows that there may be some risk to predators and scavengers via secondary exposure. However, USEPA's analysis fails to include any assessment of the exposure component of "risk" (Erickson and Urban 2004), and it is unclear how much risk is actually posed by secondary exposure. USEPA has not yet responded to many public comments concerning scientific errors, discrepancies, and methods used in their risk assessment document (Erickson 2007).

In order for a pesticide product to be used against a specific pest, it must be legally registered for use on that target species. Based on their flawed risk assessment, USEPA has proposed severe restrictions on some rodenticide products (Edwards 2007) that will make them unavailable to the general public. Will this flawed risk assessment be used to impose additional restrictions on products for prairie dog control and/or other field rodent pests?

FIELD TRIALS

Liphatech Inc. sponsored two field trials to compare the efficacy of several prairie dog bait products. In these trials, efforts were made to minimize variations between plots that might influence the efficacy of the various baits. Trials were conducted at similar sites, in close proximity, with similar colony size, topography, vegetation, land use history, etc. Applications were made at approximately the same time, in a similar manner, except with variations as discussed below.

Field Trial #1

Methods

In the first field trial, conducted on the High Plains of eastern Colorado, 3 different commercial baits (see Lee and LeFlore 2007) were used. There was no control plot in this trial. The plots were selected to contain manageable colony sizes, with at least 0.8 km between outer edges of the colonies (which was judged by the study director to be sufficient distance between plots to minimize inter-colony movement). The baits and applications were:

- Rozol Prairie Dog Bait, EPA SLN No. CO-060009 (Liphatech, Inc., Milwaukee, WI), 0.005% chlorophacinone active ingredient on whole wheat grain carrier, applied in-burrow at the rate of ¼ cup per active burrow, on a 11.9-acre test plot.
- Kaput-D Prairie Dog Bait, EPA SLN No. CO-060010 (Scimetrics Ltd., Wellington, CO), 0.0025% diphacinone active ingredient on grain carrier believed to be whole wheat, applied in-burrow at the rate of ¼ cup per active burrow, on a 12.1-acre test plot.
- ZP Rodent Bait AG, EPA Reg. No. 12455-102 (Bell Laboratories, Inc., Madison, WI), 2% zinc phosphide active ingredient on oat groats carrier, applied at the rate of 4 g (1 teaspoon) surface spot bait at the edge of prairie dog mounds for one study plot, on a 31.1-acre test plot. This product was also used on another test plot, applied in-burrow at the rate of 4 g (1 teaspoon) per active burrow, on a 11.9-acre test plot.

The chlorophacinone and diphacinone baits were applied directly into active prairie dog burrows, so that the bait was placed at least 6 inches below the surface of the ground. This is the application method required by the FIFRA Section 24(c) labels issued by the state of Colorado for these products. Only a single application of bait was made.

The zinc phosphide bait label calls for a surface spot baiting technique. The second zinc phosphide study plot was treated by the in-burrow method, in order to provide a more direct comparison with the other two baits. Both of the zinc phosphide study plots received a pre-treatment of untreated oats, using the surface spot bait or in-burrow method that would be used for the actual bait. This pre-treatment with clean grain is required by the product label and is intended to increase the prairie dogs' acceptance of the bait. This pre-treatment was followed by placement of toxic bait within 1 day, and only a single application of bait was made.

Two different methods of population survey were used: a visual count method as the primary population index, and a plugged/re-opened burrow method as the confirmatory index. The pre-treatment population surveys were conducted within 1 day before bait application, and the post-treatment surveys were to be taken 21 days following the treatment. A significant storm occurred just before the scheduled post-treatment census, burying the test plots under more than 5 feet of snow. The researchers were unable to reach the plots for census until the early spring, and so the actual post-treatment population surveys took place 105 days after treatment with the toxic bait.

Results

In this study, both the chlorophacinone bait and the diphacinone bait were shown to be more effective than zinc phosphide bait at reducing the number of prairie dogs. The results of this trial (Figure 1) showed that the chlorophacinone bait and the diphacinone baits performed equally well, and both were better than the zinc phosphide bait. It is unknown how much the weather influenced these results. The researchers' observations also prompted questions about whether prairie dogs cache the bait for later consumption; this could be investigated during future field trials.

Field Trial #2

Methods

The second field trial (see Boatman 2007) was conducted in the Texas Panhandle region in late spring. Population surveys were conducted by the same techniques as the first study, with the post-treatment surveys performed at the scheduled timing of 21 days after bait application. For this study, the following baits were used, using the in-burrow application method as previously described:

- Rozol Prairie Dog Bait, EPA SLN No. CO-060009 (Liphatech, Inc., Milwaukee, WI), 0.005% chlorophacinone active ingredient on whole wheat grain carrier, applied in-burrow at the rate of ¼ cup per active burrow, on a 2-acre test plot.
- Kaput-D Prairie Dog Bait, EPA SLN No. CO-060010 (Scimetrics Ltd., Wellington, CO), 0.0025% diphacinone active ingredient on grain carrier believed to be whole wheat, applied in-burrow at the rate of ¼ cup per active burrow, on a 2.5-acre test plot.
- Kaput-D Pocket Gopher Bait, EPA Reg. No. 725009, 0.005% diphacinone active ingredient (Scimetrics

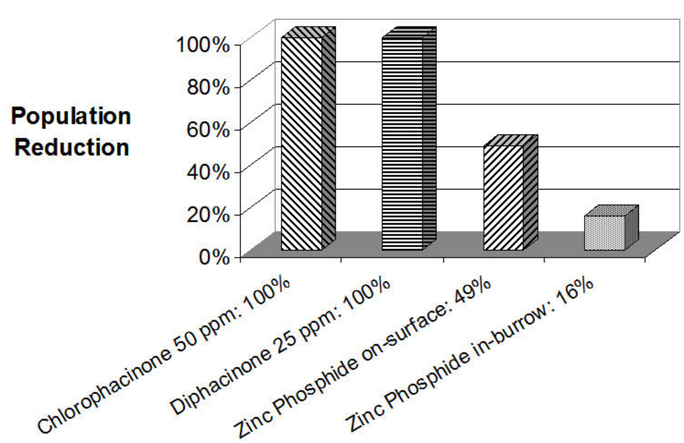

Figure 1. Results of field efficacy from Field Trial #1, High Plains of eastern Colorado (from Lee and LeFlore 2007).

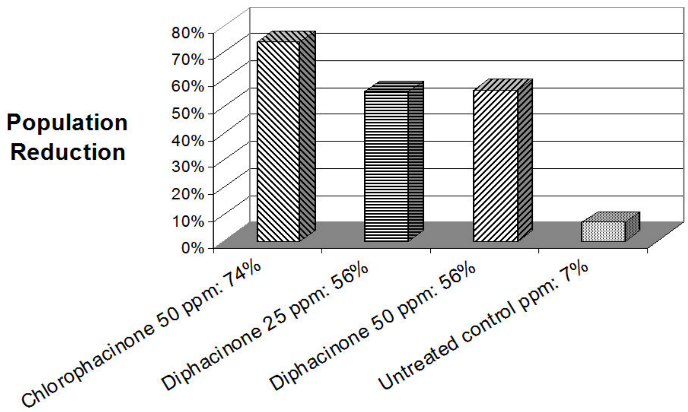

Figure 2. Results of field efficacy from Field Trial #2, Texas Panhandle (from Boatman 2007).

Ltd., Wellington, CO), 0.0025% diphacinone active ingredient on grain carrier believed to be whole wheat, applied in-burrow at the rate of ¼ cup per active burrow, on a 2-acre test plot.

Zinc phosphide bait could not be included in this trial due to label restrictions limiting use of this product to the months of July through December. An untreated control plot, 8.5 acres in size, was included in this trial. Again, plots were selected to contain manageable colony sizes, with sufficient distance between plots to minimize inter-colony movement).

Results

In this trial, the chlorophacinone bait performed better than either the 0.0025% diphacinone bait or the 0.005% diphacinone bait (Figure 2). Even then, the chlorophacinone bait barely exceeded the 70% control pass/fail criteria established by USEPA guidelines. There appeared to be little difference in efficacy between the baits containing 0.0025% diphacinone bait and 0.005% diphacinone.

DISCUSSION

The results of these two trials indicate that users may experience variations in the efficacy of different baits, but further investigation is needed to identify the factors that influence these variations. Even without a good understanding of these factors, rangeland owners and managers can better tailor their bait selection to meet the conditions on their land and their own expectations by understanding how different baits are affected by moisture and other environmental factors. These various baits can be compared as to their primary and secondary hazards to nontarget animals, and how differing label requirements for pre-baiting, bait placement, carcass searches, etc., could affect the product efficacy, potential for nontarget exposure, and the cost of application.

The label for the zinc phosphide bait allows the bait to be used only once per season, between July and December, and requires pre-baiting of each prairie dog mound with 1 teaspoon of untreated oats. One or two days later, application of the toxic bait can then be made only where the pre-bait has been consumed. This pre-baiting step can add significantly to the cost of treatment. Due to the high acute toxicity of zinc phosphide baits, users should time applications to minimize the potential exposure to nontarget birds and mammals that may visit the treatment area. Zinc phosphide bait are degraded by exposure to moisture, so the expected weather conditions must also be considered.

The chlorophacinone and diphacinone baits have similar labels that allow baiting between October 1 and the following March 15. These products are applied into the burrow, which can reduce the potential for exposure to nontarget animals. They have lower toxicity to nontarget birds and mammals than zinc phosphide bait, but users should still take into account the presence of nontarget animals when planning treatments. The chlorophacinone and diphacinone baits do not require a pre-baiting step, but they do require users to conduct post-treatment carcass searches to reduce the secondary exposure to scavengers and predators from dead or dying prairie dogs.

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