Evaluation of a Food Bait Block for Potential Chemical Delivery to Black-tailed Prairie Dogs (*Cynomys ludovicianus*)

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ABSTRACT: Fertility control is a potential method to control prairie dog populations in the urban/suburban environment. However, an effective, oral delivery system is needed. We tested a food bait block delivery system that could make baits available to prairie dogs over a number of days which would make this method more cost-effective than placing food bait by hand near burrows every day. Prairie dogs readily consumed the bait blocks stacked on vertical metal poles during the day. We found, however, that rabbits and mice also consumed the food bait blocks, mainly at night. Over the course of the study, the mean amount removed per site was 81% of the food bait presented. However, to make the food bait blocks primarily available to prairie dogs, a device that would eliminate access to the food bait blocks at night is needed.

Key Words: fertility control, food bait block, prairie dog, cottontail rabbit, wildlife damage

Proceedings of the 16th Wildlife Damage Management Conference.
(L.M. Conner, M.D. Smith, Eds). 201. Pp. 26-32.

INTRODUCTION

Prairie dogs (*Cynomys ludovicianus*) are a rodent species of the grass prairies of the USA. They pose many challenges to resource managers in highly disturbed settings, such as suburban areas, where conflicting interests persist regarding the presence of prairie dogs (Witmer et al. 2000). The history, biology, ecology, and status of prairie dogs has been reviewed by Clippinger (1989), Fagerstone and Ramey (1996), Hoogland (1996), Mulhern and Knowles (1996), and U.S. Fish and Wildlife Service (2000). There is a need to better monitor colonies and the changes that they undergo as well as a need to plan for future events. Municipalities have designed management plans to reduce conflicts by using public input, zoned management areas, and a variety of management techniques and tools. Individual populations must often be managed very differently.

The prairie dog management plans of two Colorado cities, Boulder (City of Boulder 1996) and Fort Collins (City of Fort Collins 1998), with sizeable prairie dog populations, illustrate an integrated approach to managing those populations and reducing conflicts. Each city established an advisory committee to address and resolve the management issues. Many elements and techniques are being used in an integrated management strategy, including habitat management, population management, and people management (Witmer et al. 2000). It should be noted, however, that the possible techniques can vary greatly in their effectiveness, cost, and public acceptability (Witmer 2007). For example, barriers are a popular approach to stop colonies from expanding to adjoining landowners' properties where conflicts will occur. However, adequate barriers are expensive to build and maintain and only provide limited containment of the colony (Witmer et al. 2008). Additionally, resource managers are often limited in their management options by budgetary, legal, and socio-political constraints. For example, while several rodenticides are registered for prairie dog control (Witmer and Fagerstone 2003), these are often not socio-politically acceptable, especially in urban/suburban settings.

Fertility control offers another potential solution to control expanding prairie dog colonies. The topic of wildlife fertility control was recently reviewed, including chemicals, delivery systems, advantages, disadvantages, regulatory issues, and challenges (Fagerstone et al. 2010). Previous field studies (Nash et al. 2007; Yoder 2009) indicate that the steroid diazacholesterol can effectively limit prairie dog reproduction if delivered in adequate amounts to the animals over a sufficiently long period of time before the breeding season. The chemical inhibits enzymes required for cholesterol production; hence, production of reproductive hormones from steroid precursors is prevented (Nash et al. 2007). Unfortunately, an efficient way to deliver adequate amounts of the chemical to prairie dogs over an adequate period of time is problematic. If a palatable, long-lasting food bait block system could be developed that prairie dogs would readily feed on, the steroid could potentially be incorporated. This would provide a more cost-effective method of controlling prairie dog fertility and minimizing colony expansion, thus reducing resultant conflicts.

Our objective was to determine the palatability and acceptance of a food bait block by free-ranging prairie dogs. We hypothesized that a commercially-available non-toxic commensal rodent detection food block would be readily accepted by prairie dogs. If that was the case, we will plan to incorporate diazacholesterol into a similar food bait block and test its acceptance in a subsequent field trial.

STUDY AREA AND METHODS

We obtained permission to test a food bait block in a prairie dog colony at the Fort Collins-Loveland Airport, Fort Collins, Colorado. The study was conducted in the winter as this is the time of year that a fertility control material would need to be delivered (i.e., prior to the onset of the prairie dog breeding season). The preliminary food bait block that we tested was DeTex Blox (Bell Laboratories, Inc., Madison, WI). These blocks were developed to detect the presence of commensal rodents. They are rectangular (5 x 2.5 x 2 cm) and have a hole through them so that they can be mounted on wire posts in bait stations. The baits contain ground grains, various flavorings attractive to commensal rodents, and paraffin to increase environmental longevity. The baits also contain 0.2% pyranine, a biomarker that fluoresces when exposed to ultraviolet ("black") light. Thus consumption of the food bait blocks could be confirmed by examining feces or tissues using an ultraviolet lamp.

We placed 10 food blocks in a stack using 1.2 m long, small diameter (0.8 cm) steel rods at each of 6 sites (labeled A-F) that were inserted into the soil in a vertical orientation (see Figure 1). Each block weighed, on average, 20 g so the 10 blocks on the pole weighed about 200 g. By using the poles, as the blocks were fed upon, additional blocks slid down the steel poles and become available to the prairie dogs over time. This was necessary to minimize disturbance of the animals, but also to assure that they have enough material to feed on for at least several days before replacement was needed. Bait availability of at least 10-14 days is the amount of feeding time required for the steroid concentration to build up in the animals' bodies to a level that will inhibit reproduction. Food bait "poles" were placed near burrows in the colony. A group of 4 poles was placed near burrows that were at least 30 m from another group of poles so that each pole group was exposed to different prairie dogs (i.e., different coteries which are extended family groups which defend an area from other prairie dogs). Animal activity near the poles was observed from a distance by study personnel. Additionally, infra-red motion-sensitive cameras were used to monitor animal activity, especially at night so that nocturnal, non-target animal (i.e., rabbits, other rodents) use of the food blocks could be determined. Food block poles were maintained in place for 12 days at 2 sites and 19 days at 4 other sites. The 10 food blocks were maintained over that time period by adding additional food blocks to each pole every 2-3 days as needed. When examined, if half or more (i.e., 5 or more) of the food blocks remained on a pole, that pole was left alone until the next check day. If less than 5 blocks remained, they were removed and placed in a labeled, sealable plastic bag for later weighing. Ten new food blocks were then placed on that pole. This process allowed us to determine the total amount consumed at each pole at the end of the field trial. To provide replication, 6 sites, with 4 food bait block poles each, were randomly assigned to locations in the prairie dog colony.

We also placed food blocks in 8 burrows to test whether or not the prairie dogs would feed on them in the burrows. This was done by attaching 2 food blocks to the end of a 1 m long piece of thin wire. The blocks were dropped into the burrow, but the other end of the wire was staked to the ground a short distance from the burrow opening. This was done so that the blocks could be retrieved to examine for consumption. Wires with blocks were examined every 2-3 days over a 15 day period. Food blocks were replaced as needed.

The mean and standard deviation of the amount (weight) of food bait blocks consumed was determined and compared between sites and days with *t*-tests and ANOVA, using Statistix Version 9 (Analytical Software, Tallahassee, Florida). A *P* value of ≤ 0.05 was considered to indicate a significant difference. Activity of prairie dogs and non-target animals at or near food bait poles was described qualitatively based on remote, motion-sensitive camera pictures, and to a lesser extent, by direct observation.

RESULTS

Food blocks on the metal poles were readily fed upon at all 6 sites to the extent that they had to be replaced every 2-3 days (Table 1; Figure 1). There was no significant difference ($F = 0.55$, $P = 0.6603$) in the amount removed from the poles at the 4 sites (A, C, E and F) that were operated for the same length of time. There was also no significant difference ($t = 1.31$, $P = 0.2394$) in the amount removed from the poles at the other 2 sites (B and D) that were operated for the same length of time, but a shorter period than the previously mentioned 4 sites. The mean amount removed per site was 81% of the food bait presented. There was significantly less ($t = 5.67$, $P = 0.0002$) removed when the food blocks were first put out (i.e., amounts removed on Day 3 versus Day 5), perhaps because of neophobia to the new objects on the landscape. After Day 3, however, food removal from the poles remained high across sites, although significantly more ($F = 6.54$, $P = 0.0029$) was removed on some days rather than others, perhaps because of varying weather conditions. For example, on Day 10 only 24.8 food blocks were removed from the 4 poles, on average, at each site versus all 40 food blocks being removed on Day 8.

It appeared that the food blocks may have been consumed in the burrows, but we cannot definitively conclude that was the case. Most often, both food blocks were gone when the wire holding them was checked. The number of blocks consumed did not differ significantly ($F = 1.97$, $P = 0.0884$) between the 8 burrows used. However, about half of the times that the wires were checked, the wire was found to be outside the burrow with the food blocks missing. It is possible that animals pulled or pushed the blocks out to the surface before feeding on them or they may have consumed them in the burrow and then pushed the wire out. While we used cameras at these burrow sites for a few days, we could not conclude whether prairie dogs or rabbits were mainly consuming the blocks. The pictures often showed the wire extending into the burrow and then the next picture (taken 15 minutes later because we were using a time-delay mechanism), would show the wire out of the burrow. In a few cases, pictures showed prairie dogs feeding on the blocks outside of the burrow, but a few nighttime pictures also showed rabbits and mice feeding on the blocks outside of the burrows.

The remote cameras captured 948 daytime pictures of prairie dogs in the vicinity of the poles, often gnawing at the food blocks (Figure 1). As many as 7 individual prairie dogs were on the surface at a site with poles at one time. No nighttime pictures of prairie dogs were obtained which was expected as the species exhibits diurnal activity patterns. In addition to daytime pictures, the infrared lighting system of the cameras resulted in numerous nighttime pictures of animals, mainly mice and rabbits (Figure 2). A total of 2,422 pictures had rabbits (*Sylvilagus* spp.) in them, while 311 pictures had mice (*Peromyscus* spp.) in them. There were significantly more (F = 10.27, P = 0.0016) pictures of rabbits than prairie dogs or mice. There were significantly more (t = 4.23, P = 0.0018) pictures of rabbits at night (2,388) than during the day (34), showing primarily nocturnal activity patterns. As many as 6 individual rabbits were on the surface at a site with poles at one time. We also obtained a small number of pictures of diurnal birds (mainly larks and sparrows), one picture of a coyote (*Canis latrans*), and one picture of a nocturnal owl swooping near the ground surface.

It was clear from the pictures that prairie dogs were the main species feeding on the food blocks during the day. However, the pictures also made it clear that rabbits (and to a lesser extent mice) were feeding on the food blocks at night. By noting the number of food blocks on the poles at the end of the day and again in the morning, we estimated that the rabbits were consuming significantly more (t = 2.46, P = 0.0335) of the food blocks at night than the targeted species, prairie dogs, during the day (Figure 3).

We collected some pellets from 20 different prairie dog fecal groups. Eight of the 20 samples (40%) fluoresced under ultraviolet light. We also collected one sample of mice fecal droppings and this fluoresced, but neither of the two samples collected of rabbit fecal pellets fluoresced.

Table 1. Amount (g) of food bait consumed at each pole and each site[a].

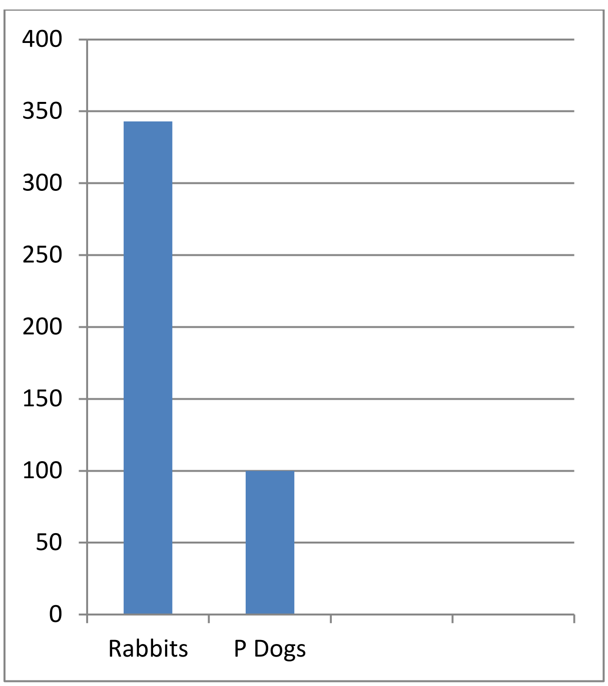
	Site A	Site C	Site E	Site F	Site B	Site D
Pole 1	1154	1204	1012	1003	802	970
Pole 2	1204	1168	1130	1139	802	739
Pole 3	1170	1003	1112	1140	802	571
Pole 4	1404	1300	1244	1361	1003	569
Mean (S.D.)	1233.0	1168.8	1124.5	1160.8	852.3	712.3
	(115.9)	(123.8)	(95.1)	(148.2)	(100.5)	(189.4)
% Removed	87.8	83.2	77.3	80.9	85.0	71.0

[a]Sites A, C, E and F were operated for 19 days with a total of 1404.2 g of food bait was presented, whereas Sites B and D were operated only 12 days with a total of 1003 g of food bait presented.

Figure 1. Photograph of prairie dogs feeding on the food bait blocks.

Figure 2. Photograph of rabbits eating food bait blocks at night.

Figure 3. Estimated total number of food bait blocks consumed by rabbits versus prairie dogs.



DISCUSSION

There are a number of challenges to be overcome before a fertility control material can be used to control rodent populations. First, an oral delivery system must be developed as direct injection of each rodent is not practical, although there is a product registered for injection of white-tailed deer (*Odocoileus virginianus*; Miller et al. 2000). An oral delivery system would be most practical for seasonally breeding rodent species (e.g., prairie dogs) versus continuously breeding species (commensal rats, *Rattus* spp., and house mice, *Mus musculus*).

The second challenge is achieving species specificity in the delivery system so that only the targeted species is rendered infertile. We identified an effective delivery system to get a fertility control material to free-ranging prairie dogs over a period of time, thus reducing labor and travel requirements. However, the lack of pyranine dye in 60% of the prairie dog pellet groups examined suggests that not all prairie dogs are consuming the food bait blocks. This could be due to dominance hierarchies in the coteries. We caution, however, that only a small number of pellet groups were examined for fluorescence and some of the pellet groups may have been older (i.e., excreted by animals before the food bait blocks were available for several days). If this fertility control delivery system is to be pursued further, the next requirement would be to incorporate the diazacholesterol into a palatable food bait block for testing in the field. This might require collaboration with a rodenticide manufacturing company.

As such, it appears that it may be possible to overcome the first challenge of an oral delivery system. Additional effort will be required to overcome the second challenge of species specificity of the fertility control delivery system. We could not determine if placement of the food blocks in the burrows reduced non-target animal consumption. Based on the camera pictures, the main non-target exposure of food bait blocks on poles was to rabbits and this occurred mainly at night. Hence, it might be possible to develop an automated system that will uncover the food bait blocks during the day to allow prairie dogs to feed on them, but then cover the food bait blocks at night to restrict feeding by rabbits and mice. Such a device could be powered by battery or solar panel.

ACKNOWLEDGMENTS

We thank the personnel of the Loveland-Fort Collins Airport for allowing us to conduct the study at the airport. This study was conducted under the IACUC-approved Study Protocol QA-1755. Lowell Miller and Christi Yoder provided useful comments during the study design. Mention of a commercial product or company does not represent an endorsement by the U.S. government.

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