Use of BurrowRx® Carbon Monoxide Generator to Control Black-tailed Prairie Dogs in Montana: A Pilot Study

Stephen M. Vantassel
Montana Department of Agriculture, Lewistown, Montana

ABSTRACT: In recent years, there has been increasing interest in the use of carbon monoxide-generating devices to control burrowing rodents. A pilot study was performed to determine how long a black-tailed prairie dog burrow needed to be fumigated with a BurrowRx® machine to obtain control. This pilot study obtained 92% efficacy with a four-minute injection, 86.7% with a 3:45-minute injection and 90% efficacy with a three-minute injection. Out of 59 burrows, 85% had only a single entrance. Of the nine that had two or more openings, six had only two, one had three openings, and two had five openings. Surface measurements from the treated opening to the furthest connected opening ranged from 10 feet to 43 feet with the average being 23.33 feet. The paper also discusses suggestions for further research and suggestions for practical use of the device.

KEY WORDS: BurrowRx, burrow structure, carbon monoxide, *Cynomys ludovicianus*, fumigation, prairie dog control

Proceedings, 30th Vertebrate Pest Conference (D. M. Woods, Ed.)
Paper No. 24. Published December 27, 2022. 4 pp.

INTRODUCTION

Black-tailed prairie dog (*Cynomys ludovicianus*) burrowing and foraging can cause significant damage to pastures and rangelands (Baldwin et al. 2020). Although effective rodenticides and fumigants are available to manage prairie dog numbers, many people choose to avoid pesticides on account of safety concerns, regulations, or a belief that they are not effective. Shooting and trapping are alternative control methods, but they can require significant time investments to obtain desired results.

The development of carbon monoxide generators introduced a new tool for the management of burrowing rodents. These devices, of which there are several models, use the exhaust from a gasoline powered engine to fumigate burrowing animals. Unfortunately, research on the effectiveness of carbon-monoxide generators extends only to the PERC® (H&M Gopher Control, Tulelake, CA) and BurrowRx® (Quality Manufacturing and Distributing Inc., El Cajon, CA) and none pertains to the control of prairie dogs. The research question was not on whether carbon monoxide generators could control prairie dogs. It was perfectly reasonable to conclude that if carbon monoxide from ignitable gas cartridges could control prairie dogs, so could carbon monoxide generators. Additionally, anecdotal reports on the devices' effectiveness ground-truthed that conclusion. The real question was, "How long should a burrow be fumigated to achieve control?" The answer to this question would be device and possibly soil specific.

Having received a BurrowRx machine, the Montana Department of Agriculture's Vertebrate Pest Specialist decided to test the device on small prairie dog towns outside of Helena, Montana. The study had several goals. The first goal was to evaluate the efficacy of BurrowRx's recommended injection time of four minutes. If four minutes was sufficient to obtain a sufficient control, further work would evaluate the efficacy of shorter injection times. A second goal related to obtaining a better understanding of prairie dog burrow structure. BurrowRx provides users with the option of using "smoke oil" which adds color to the exhaust, permitting applicators to see whether other burrows are connected to the one being treated. A third goal sought to gain some hands-on experience with the device to improve instructor background and instructional content.

METHODS

The BurrowRx machine consists of a Briggs & Stratton (Wauwatosa, WI) Vanguard 203cc Horizontal 6.5 HP four-cycle engine built in 2016. The engine exhaust is connected to a chamber for application of the smoke oil which in turn is connected to a high- temperature flexible hose. The engine is housed on a two-wheel cart with a handle capable of holding the accompanying 10-foot hose and a pint bottle of smoke oil. The device was unboxed, oil (which accompanied the shipment) was added to the engine and the handle was attached. The manufacturer recommends using super grade gasoline, presumably to avoid ethanol which is added to lower gasoline grades. After filling the fuel tank, the author tested it to become familiar with the device and to ensure it worked before entering the field.

Site 1 consisted of a 20-acre property in the Helena Valley north of Helena, Montana. The area consists of residential homes with acreage characteristic of exurban landscapes (Newburn and Berk 2011). The main residence and a housing trailer were on 5 acres in the NW corner. Two horse pens to the south and southeast were approximately 5 acres respectively. The final 5 acres consisted of a fenced pasture. The owner said the property had prairie dogs since his purchase several years ago but that the numbers have since grown. Prairie dogs were also present on the neighbor's property immediately to the west. Soil is Geohrock gravelly loam, 2% to 8% slopes.

Site 2 was located on a farm on the eastern side of the Helena Valley approximately 5.3 miles air miles southeast from Area 1. The farm was growing alfalfa under pivot irrigation. Soil is classified as Musselshell-Crago

Table 1. Efficacy of treatment with differing duration of injection of carbon monoxide.

Time	Throttle	Opened	Total	Opened/ Total	Efficacy
4:00	3/4	2	24	0.08333	92%
3:45	3/4	2	15	0.13	86.7%
3:00	Full	2	20	0.10	90%

Table 2. Data from Site 1 (west side of Helena Valley); injection duration of 4 minutes.

				Treat 6/28/22	Treat 6/29/22	Inspect 1 6/29/22	Inspect 2 6/30/22	Inspect 3 7/1/22	Inspect 3 >1800 h 7/2/22		
Burrow	Time	Holes	PDs	6/28/21	6/29/21	6/29/21	6/30/21	7/1/21	7/02/21	Throttle	Hose
1	4:00	1	1	x		0	0	0		3/4	short
2	4:00	2	1	x		1/0	0/0	0/0		3/4	short
3ab	4:00	2	1	x		0/0	0/0	1/0		3/4	short
4	4:00	1	1	x		0	0	0		3/4	short
5	4:00	1	1	x		0	0	0		3/4	short
6ab	4:00	2	2	x		0	1/1	1/0		3/4	short
7	4:00	1	1	x		0	0	0		3/4	short
8	4:00	1	1	x		0	0	0		3/4	short
9	4:00	1	1	x		0	0	0		3/4	short
10	4:00	1	1	x		0	0	0		3/4	short
11	4:00	1	1	x		0	0	0		3/4	short
12	4:00	1	1	x		0/0	0/0	0/0		3/4	short
13	4:00	2	1	x		0	0	0		3/4	short
14	4:00	1	1	x		0	0	0		3/4	short
15	4:00	1	1	x		0	0	0		3/4	short
16	4:16	2	1	x		0/0	0/0	0/0		3/4	short
17	4:00	1	1	x		0	0	0		3/4	short
18	4:00	1	1	x		0	0	0		3/4	short
19	4:00	1	1	x		0	0	0		3/4	short
20	4:00	1	1	x		0	0	0		3/4	short
27	4:00	1	1	x		0	0	0		3/4	short
32	4:00	1	1		x		1	0	0	3/4	short
33	4:00	1	1		x		0	0	0	3/4	short
34	4:00	1	1		x		0	1	0	3/4	short

complex 2 to 8 percent slopes (USDA-NRCS 2022). Prairie dogs were concentrated in the areas outside the pivot circle but were encroaching the pivot area. The area treated was approximately 8 acres in area.

Since the goal of the study was to determine an effective injection time, burrows were only fumigated when a prairie dog was sighted entering the burrow. Upon arrival, the hose was inserted into the burrow with some shaking and wiggling to ensure the hose entered at a reasonable distance, usually three feet or so. Soil was then shoveled around the hose. After adding smoke oil (approximately ⅔ of the holder's volume), the engine was started and run for the specified period (i.e., 4:00, 3:45 or 3:00 minutes). The applicator monitored the area for smoke emerging from connected holes and sealed them as quickly as possible. Treated burrows were flagged. For burrows with more than one entrance, a wheel measuring tool was used to calculate the distance from the treated hole to the furthest connected opening.

Burrows were monitored for the next two to three days to determine if the holes remained closed. A treatment was considered successful if the holes were not opened twice and/or the hole was not opened on the last day of inspection. This decision was made because some of the treatments could only be monitored for two days. An additional, though lesser reason, related to the fact that sometimes holes would partially reopen due to settling of the extremely dry soil. The study period was short, occurring between June 28 and July 2, 2021.

RESULTS

A total of 59 treated burrows were included in study. It was clear to the author that the treatments worked under all the injection times: 92% efficacy was obtained with a four-minute injection, 86.7% with a 3:45-minute injection, and 90% efficacy with a three-minute injection. A summary of the results is provided in Table 1. The raw data are presented in Tables 2-4.

Table 3. Data from Site 1 (west side of Helena Valley); injection duration of 3 minutes 45 seconds.

				Treat	Treat	Inspect 1	Inspect 2	Inspect 3	Inspect 3 >1800 h		
Burrow	Time	Holes	PDs	6/28	6/29	6/29	6/30	7/1	7/2	Throttle	Hose
21	3:45	1	1	x		0	0	0		3/4	short
22	3:45	1	1	x		0	0	0		3/4	short
23	3:45	1	1	x		0	0	0		3/4	short
24	3:45	1	1	x		0	0	0		3/4	short
25	3:45	1	1	x		0	0	0		3/4	short
26	3:45	1	1	x		0	0	0		3/4	short
28	3:45	1	1	x		0	0	0		3/4	short
29	3:45	1	1	x		0	0	0		3/4	short
30	3:45	1	1	x		0	0	0		3/4	short
31	3:45?	1	1	x		1 photo open	0	0		3/4	short
35	3:45	1	1		x		0	0	0	3/4	short
36	3:45	1	1		x		0 crack in photo	0	1	3/4	short
37	3:45	1	1		x		1	0	1	3/4	short
38	3:45	1	1		x		1	0	0	3/4	short
39	3:45	1	1		x		0	0	0	3/4	short

Table 4. Data from Site 2 (eastern Helena Valley); injection duration of 3 minutes.

					Treatment	Hose	Treatment	Inspect 1	Inspect 2	Inspect 3 7/2/22 ~1830 h
Burrow	Time	Holes	PDs	Throttle	6/29	Hose	6/30	6/30	7/1	07/2
1	3:00	1	1	3/4	x	SH		0	1	0
2	3:00	1	1	3/4	x	SH		0	0	0
3	3:00	1	1	3/4	x	SH		0	0	0
4	3:00	1	1	3/4	x	SH		0	0	0
5	3:00	1	1	Full	x	LH		0	0	0
6	3:00	2	2	Full	x	LH		0	0	0
7	3:00	1	1	Full	x	LH		0	0	0
8a-e	3:00	5	1	Full	x	LH		A	0	0
9	3:00	1	1	Full	x	LH		0	0	0
10ab	3:00	2	1	Full	x	LH		0	0	0
11	3:00	1	1	Full	x		SH		0	0
12	3:00	1	1	Full	x		SH		0	0
13a-e	3:09	5	1	Full	x		SH		0	0
14	3:00	1	1	Full	x		SH		0	0
15	3:00	3	1	Full	x		LH		0	1
16	3:00	1	1	Full	x		LH		0	0
17	3:00	1	1	Full	x		LH		1	0
18	3:00	1	1	Full	x		LH		0	0
19	3:00	1	1	Full	x		LH		0	0
20	3:00	1	1	Full	x		LH		1	1

DISCUSSION

As a pilot study, several issues were encountered that were not previously known. The most important issue was the engine's throttle which was not discovered until hole number 5 in Site 2. The throttle was originally set at approximately ¾ open. It was then moved to full throttle for the remainder of the treatments. How that adjustment may have affected treatment efficacy is unknown, but it is likely that it had at least a marginal impact perhaps of a few percentage points.

A second issue was hose length. The device can be used with a short hose (10 feet) or a long hose (25 feet) or both. The short hose was used at Site 1 and for a few burrows in Site 2. But the 35-foot hose was used for several burrows in Site 2. While it is doubtful that the hose length noticeably affected control, it is possible that the use of a longer hose, coupled with the shorter injection time, reduced the amount of carbon monoxide entering the burrow.

Table 5. Burrows with more than one opening.

Burrow	Distance in Feet	Number of Holes
2	25.00	2
3	24.00	2
6	22.00	2
13	13.00	2
16	43.00	2
8	16.00	5
10	25.00	2
13	32.00	5
15	10.00	3
Average	**23.33**	**2.78**

The study suffered from typical human error caused by inattention as well as the inevitable development that occurs when learning a new control method. For example, on a couple of treatments treatment length varied from the stated time limit. Each of these errors were noted in the respective tables. While those errors are regrettable, it is unlikely that they have a meaningful impact on the results.

The author was somewhat surprised to see that burrows were not reopened by prairie dogs from untreated burrows, such as those from the adjacent property. Prairie dog disturbance of closed burrows was a significant problem during the propane-oxygen exploder study (Vantassel 2018). Perhaps prairie dogs' intra-town movement is lower during late June-early July than it is during March during the previous study.

BurrowRx treatments confirmed Hoogland's (1995) assertion that most burrows have one or two openings with a few with three. In this study, out of 59 burrows, only nine (15%) had more than one opening (Table 5). Interestingly, the connected entrance is not always the nearest burrow opening.

ACKNOWLEDGEMENTS

The author would like to thank the two landowners for granting access to their land. Their contribution made this research possible.

LITERATURE CITED

Baldwin, R. A., T. A. Becchetti, J. S. Davy, R. E. Larsen, F. E. Mashiri, R. Meinerz, R. K. Ozeran, and D. Rao. 2022. Estimating reduction in standing crop biomass from California ground squirrels in central California rangelands. Rangeland Ecology and Management 83:50-58.

Hoogland, J. L. 1995. The black-tailed prairie dog: social life of a burrowing mammal. University of Chicago Press, Chicago, IL.

Newburn, D., and P. Berk. 2011. On exurban development. Journal of Environmental Economics and Management. 62(3):323-336.

Vantassel, S. M. 2018. Evaluating the efficacy of the Rodenator™ (propane-oxygen device) for control of black-tailed prairie dogs in Montana. Proceedings of Vertebrate Pest Conference 28:180-183.

USDA-NRCS. 2022. Soil Survey. U.S. Department of Agriculture-Natural Resource Conservation Service. Accessed 02 March 2022 at https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx.