

Using Burrow Builders for Pocket Gopher Control

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This NebGuide discusses how to use tractor-drawn mechanical bait applicators to manage pocket gophers. Additional information about pocket gophers can be found in NebGuide G1509.

Pocket Gopher Damage and Costs

Plains pocket gophers (*Geomys bursarius halli*), the most common of four species of pocket gopher in Nebraska, spend nearly their entire lives underground and may only appear aboveground when they excavate soil to the surface or when they disperse to new areas. Each animal can move up to a ton of soil during a year and create dozens of mounds. Pocket gophers create more mounds in spring and fall than in winter or summer. A pocket gopher's burrow system may cover 1 to 2 acres. Each adult pocket gopher occupies its own burrow system most of the year, but they can quickly occupy a neighboring burrow if a resident disappears. For plains pocket gophers, a population of six to eight animals per acre is considered high density.

Pocket gophers damage more than \$10 million of major field crops in Nebraska each year. They can cause yield reductions up to 30 to 40 percent in areas of alfalfa fields, hay meadows, and rangeland they inhabit.

Conversely, pocket gophers have a beneficial ecological role, providing food for a variety of predators. The burrowing and excavation activities of pocket gophers promote the vertical cycling and mixing of soil constituents, and increase aeration and water infiltration.

Burrow Builders

Burrow builders (*Figure 1*), also known as gopher machines and gopher getters, are tractor-drawn implements that create tunnels through the soil and drop a measured amount of toxic grain bait into tunnels. The tunnels created intercept or come near the burrows of pocket gophers. Pocket gophers, through their natural digging activities, intercept and enter the tunnels, and eat the toxic bait.

Burrow builders are most commonly used in alfalfa fields, pastures, orchards, windbreaks, cemeteries, golf courses, parks, roadsides, and playing fields to reduce pocket gopher damage. Burrow builders also can be useful in treating pocket gophers in rough terrain and forested areas. When treating rough terrain,



Figure 1. A burrow builder or “gopher getter.”

pull burrow builders with tracked vehicles connected by free-floating hitches. Burrow builders are used most successfully when the following conditions exist: 1) large fields that have extensive pocket gopher populations at high densities; 2) the effects of control and evaluation of control can be delayed for several days; and 3) hand baiting and trapping have been considered and deemed impractical.

Consider renting rather than owning a burrow builder. A few farm machinery dealers and Natural Resource Districts have rental units. Rental rates may be by the day or acre or by the amount of bait used. Some private owners may rent to others in the community. Rental fees range from \$15.00 to \$65.00 per day (2010 rates). Check your local extension office or Natural Resources District offices for contacts of people willing to rent a burrow builder. Prices for new burrow builders vary considerably between models and brands, from \$1,500 to \$4,000. Custom rates for burrow builder operations usually are about \$5.00 per acre. Information on suppliers and manufacturers of burrow builders are included in *Table I*.

Before You Use Burrow Builders

Soil that has difficulty maintaining the integrity of tunnels, (e.g., excessively dry or wet) will limit success with burrow builders. In certain areas, such as golf courses, burrow builders may not be acceptable because of the amount of disturbance to sod or plant roots that the machines create. If the area that needs management is not extensive, use other methods, such as hand baiting or trapping.

Table I. Burrow builder suppliers and manufacturers.*

Elston Manufacturing, Inc. 706 N. Weber Sioux Falls, SD 57103 (800) 845-1385 (605) 336-7716 www.elstonmfg.com	Eckroat Seed Co. 1106 Martin Luther King Ave. Oklahoma City, OK 73117 (800) 331-7333 (405) 427-2484 www.eckroatseed.com
Central Supply and Rubber Company 109 N. 9th St. Omaha, NE 68102 (800) 444-8666 www.centralsupplyandrubber.com	The Feed Shed 412 W. 29th St. South Sioux City, NE 68776-3129 (402) 494-0141
All American Ag (The Verminator) 16441 Hwy 12 Touchet, WA 99360 (509) 520-4055 www.allamag.com/theverminator/	Beaver Valley Supply Co. P.O. Box 419 Atwood, KS 67730 (800) 982-1280 www.beavervalleysupply.com

*The list is not exhaustive.

Consider each control situation individually. Greater levels of control are desired in high-value areas, such as orchards, windbreaks, and golf courses. In contrast, the levels of control in rangeland can be lower. Before initiating a control program, weigh the benefits of pocket gophers, such as their mixing and aerating soils, against the cost of their damage and control.

Examine the field and note the number and distribution of pocket gopher mounds. Determine the areas most recently affected by pocket gophers. Fresh mounds are taller, darker in color (due to moisture), and have finely granulated soil. If mounding is extensive, you may need to use a tractor-drawn leveler, harrow, float, or rod weeder to flatten mounds so that you can determine where recent activity is occurring at a later date. Check with Diggers Hotline of Nebraska (800-331-5666, www.ne-diggers.com) to confirm if any underground utilities or objects are present. If so, take care to avoid underground electrical lines, telephone lines, irrigation pipes, and other objects while using a burrow builder.

Burrow Builder Design and Operation

Burrow builders consist of five basic parts: 1) a rolling coultter blade, 2) a knife or shank opener and torpedo tube, 3) a packer or press wheel, 4) a seed box or bait hopper, and 5) a metering unit that controls the rate of bait flow from the box (Figure 2). Most burrow builders are hydraulically operated and mount on the three-point hitch of a tractor. A tractor rated at a minimum of 50 horsepower is required. Additional horsepower will be needed in clay soils, soils with many roots, and with longer torpedo tubes. Four-wheel drive pickups also can be used for pull-type burrow builders.

The rolling coultter blade cuts surface trash and shallow roots ahead of the shank. Align the coultter to cut directly in front of the

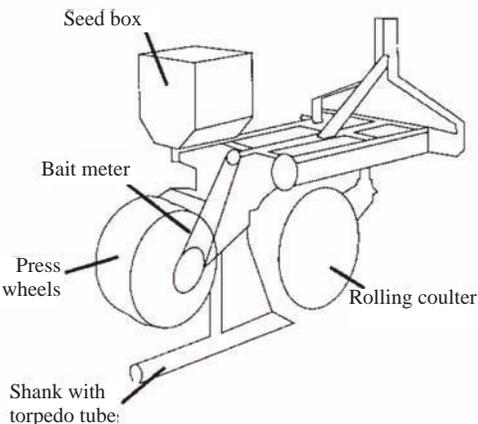


Figure 2. Give basic parts of a burrow builder: 1) rolling coultter, 2) shank with torpedo tube, 3) bait box, 4) bait meter, 5) press wheel(s).

shank at a depth of 4 to 6 inches. Trash will build up occasionally between the shank and coultter blade in some models or in some field conditions. During treatment, periodically stop, disconnect the power, and check and clean the shank. Chrome-plated shanks resist abrasion in sandy and rocky soils. The plating also improves scouring of the point and creates a better tunnel.

Set torpedo tubes parallel or tipped slightly downward to the soil surface so they bite into the soil. Operate the tube at the same depth as the burrows of pocket gophers in your area. Dig through several mounds to the horizontal tunnel to determine the correct depth of the torpedo tube. You may need to add weight to the machine to force the shank and tube to penetrate the ground to the correct depth. Raise the shank out of the ground when making sharp turns to avoid damaging the machine. Check for and remove any bait that is found on the soil surface to avoid poisoning other animals. Dispose of spilled bait in pocket gopher burrows or as directed on the pesticide label. Lower or raise shanks only when the tractor is moving forward to prevent undue strain on both tractor and burrow builder. Do not stop the tractor while it faces uphill to avoid the clogging of the bait outlet. Check the outlet and level of bait in the hopper periodically during operations to confirm that bait is being dispensed. Check the press wheel sprocket that drives the bait metering sprocket periodically to ensure bait is dispensed. Select sprockets and/or seed plates to match bait types and to achieve the desired rate of bait flow. Positive flow seed meters improve bait placement.

The press wheel should close the narrow slit at the top of the tunnel formed by the upper portion of the shank. Adjust the press wheel pressure to achieve proper closure of the tunnel. If too much pressure is applied, the tunnel will collapse and the bait will be buried. If too little pressure, the tunnel will be open to sunlight and cause pocket gophers to block off access and avoid your newly created and baited tunnel. Soil moisture should be near the upper limit of the range used for plowing or cultivating, when using a burrow builder. Dig down about 8 inches to the level of a pocket gopher's burrow. Collect a handful of soil and squeeze it. The soil should stick together and not drip water. In very sandy soils, the best conditions may be only a day or two after rainfall or irrigation. Test your settings by making a tunnel about 50 feet long. Then dig a cross section out of the newly formed tunnel. Dig down slightly below the tunnel and remove all loose soil from the hole. Look and feel to see if a clean, open tunnel has been created in both directions. For better inspection, dig out two holes that cross-section the tunnel as described above and at 6-foot intervals along the length of the tunnel. Direct a flashlight into the tunnel opened by one hole that leads toward the other hole (Figure 3). Use the back of a bright shovel inserted into the second hole to reflect the light from the flashlight, indicating a clean, well-formed tunnel.

Pull the machine across rows of mounds and near the newest mounds to intercept as many burrows as possible

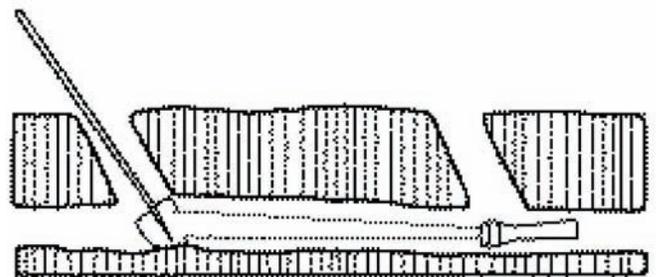


Figure 3. Inspecting a well-formed tunnel with a flashlight and the back of a shovel.

(Figure 4). Make a crisscross pattern of tunnels only in areas of the field that contain old or new mounds to reduce the cost of operation. Old mounds are flatter and a lighter brown tone in color than new mounds, and new mounds can lose their distinction in only a day if drying winds are present. Run

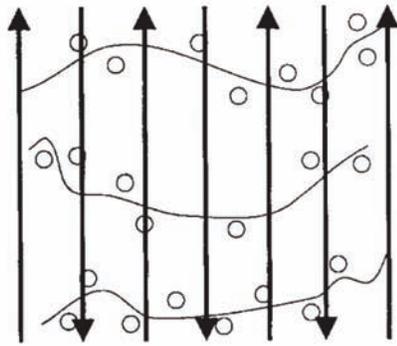


Figure 4. Passes of burrow builder across rows of mounds.

the torpedo tube below the ground only for short distances in areas that contain gopher mounds. Otherwise, the created tunnels may serve as runways to spread gopher activity. Space the tunnels as recommended on the pesticide label.

Use in Alfalfa. Look for patterns of pocket gopher mounds that indicate individual burrow systems. Mounds are most visible in spring, prior to and during green-up and after a cutting of hay. Treat areas that contain new mounds. Higher densities of pocket gophers often appear along levees or ditches than elsewhere in flood-irrigated alfalfa fields. Apply bait parallel and on either side of levees, ditches, and terraces. Elsewhere, create short runs with the torpedo tube to avoid creating extensive tunnels through which gophers may spread. Since the rolling coulter and shank can damage roots and crowns of alfalfa, do not treat areas that have no evidence of current pocket gopher activity.

Use in Windbreaks, Orchards, Christmas Tree Plantations, and Other Specialty Crops. In these areas, it is best to create short runs of tunnels that run parallel to rows of trees. Lift the torpedo tube out of the ground wherever mounds are not present, and every 75 to 100 feet in new plantings of trees with sparse evidence of pocket gophers. Place a tunnel between rows and on either side of the plantation. To avoid damage to tree roots in older plantations, select a tunnel depth and distance from the trees based on the growth form of the roots of each tree species. Avoid buried irrigation pipes, stumps and other objects. Tunnel interruption that occurs by the occasional removal of the torpedo tube from the ground will not significantly diminish the efficacy of control.

Selecting Baits and Toxicants. Grain baits treated with strychnine alkaloid, zinc phosphide, or diphacinone are currently registered for use in mechanical bait applicators for control of pocket gophers. Always apply fresh bait and store excess in a dry and secure location. Use seed plates in your seed box that work best with the chosen grain. Strychnine acts more quickly than zinc phosphide but cannot be used in feed or food crop areas. Formulations may differ in percentage of active ingredient. Select higher concentrations so fewer bait pieces or grains are required to kill a pocket gopher and less bait is applied. Populations of pocket gophers can be reduced 85 to 95 percent at application rates of 1 to 2 pounds per acre of 0.3 to 0.5 percent strychnine alkaloid grain.

Baits treated with zinc phosphide are available at 2 percent active ingredient and are registered for application at a variety of sites. Effectiveness of this bait ranges from 10 to 50 percent when applied at 1 to 2 pounds per acre. Select grain baits, such as hulled, rolled, or crimped oats.

The anticoagulant chlorophacinone is the latest toxicant for use in burrow builders. It can be applied to lawns, golf courses, alfalfa fields, rangelands, orchards, groves, and noncrop areas. Baits treated with chlorophacinone must be

applied at 6 to 8 pounds per acre because pocket gophers must consume more bait to achieve a lethal dose. One advantage with chlorophacinone is that accidental poisonings can be treated with vitamin K.

Safety Precautions and Legal Restrictions. Do not apply any toxic baits for pocket gophers above the ground. Gophers rarely feed aboveground and the baits are hazardous to nontarget wildlife. On models not equipped with brakes on free-floating press wheels, bait may fall through the shank as the machine is raised, leaving hazardous toxicant aboveground. Since it is illegal to leave spilled bait aboveground, bury spilled grain out of reach of animals or apply as directed on the label. Remove all bait from burrow builders after use. Store unused bait in a proper and marked container and in cool, dry, and secure storage area.

Hazards to humans applying zinc phosphide or strychnine include:

- Harmful or fatal if swallowed.
- Do not get in eyes or on skin or clothing.
- Do not breathe the dust or fumes.

Human safety precautions when handling rodenticides include:

- Wear rubber gloves (nitrile if allergic to rubber) and a long-sleeved shirt when handling.
- Wash all materials and utensils that have contacted the rodenticide.
- Wash your skin with soap and water after applying the rodenticide and before eating or smoking.
- Wash clothing separately.

All the rodenticides mentioned are Restricted Use Pesticides (RUP). Obtain a commercial or private pesticide applicator's license before applying these rodenticides, or hire a licensed custom applicator. Guidelines for obtaining licenses are available at your local extension office. Grain treated with zinc phosphide or strychnine is available through USDA-APHIS-Wildlife Services, 5940 S. 58th St., Lincoln, NE, 68516; (402) 434-2340. The pesticide label must explicitly mention burrow builders for the product to be applied. Use of strychnine is further limited to belowground applications. Commercial suppliers may be listed under Agricultural Chemicals in the Yellow Pages Directory.

Application Rate. The amount of bait needed depends on the type and rate of bait in each drop, the distance between drops, and the distance between passes of the machine. Read the pesticide label and apply according to label guidelines. Labels typically allow 3 pounds or less per acre. Select the correct seed plate to control the amount of bait in each drop. Select the correct drive sprockets for the bait hopper and press wheel to control the distance between drops. Select longer distances between drops if you plan to operate through an entire field. Choose shorter distances if you selectively operate through specific areas where burrows are present or specific burrow systems. Follow the pesticide label for row spacing.

Most burrow builders should be operated at less than 5 miles per hour for best performance. At a tractor speed of 4 miles per hour and a row spacing of 20 feet, an operator can treat about 10 acres per hour. Use the following procedure if the operator's manual does not specify how to calibrate the machine to apply a known rate of bait. Weigh untreated grain and place it in the seed box. Operate the machine for 1,000 feet at the determined depth and speed. Weigh the grain that remains in the seed box and subtract this amount from the original amount to determine the amount applied. Look for this amount in *Table II, Column 1*. Read across to the amount

under the desired row spacing to determine the amount of bait applied per acre.

Table II. Pounds of bait applied per acre with burrow builders at different distances between passes.

Pounds Applied Per 1,000 ft	10 ft between passes	14 ft between passes	20 ft between passes	24 ft between passes
0.5	2.2	1.6	1.1	0.91
1.0	4.4	3.1	2.2	1.8
1.5	6.5	4.7	3.3	2.7
2.0	8.7	6.2	4.4	3.6
2.5	10.9	7.8	5.4	4.5
3.0	13.1	9.3	6.5	5.4

For example, if 0.9 pounds of bait was applied per 1,000 feet of tunnel, then about 2 pounds per acre would be applied when using a 20-foot distance between passes. If a higher or lower rate is desired, change the seed plates, drive sprockets, and/or distance between passes. Repeat the test.

Assessing Effectiveness of Control

Option 1 — A drag can be pulled behind a burrow builder machine at the time of operation to flatten all mounds. Alternately, you can use a scraper or a harrow in a separate operation to knock down mounds (Figure 5). The soil should lay evenly distributed across the surface. Then, examine any new mounds that are created after toxic baits are applied. Allow one week for gophers to locate the tunnels and eat the bait or for them to create new mounds.



Figure 5. A scraper blade or harrow operation following the burrow builder operation is one technique used to evaluate control. (Photo by Dallas Virchow.)

Option 2 — Several days before using a burrow builder, visit the area to be controlled and dig through a new mound in each pocket gopher burrow system. Be sure that you open only one hole per system. If mound systems cannot be distinguished, walk about 50 feet before opening another mound. Open and flag at least 25 mounds. Return the following day to count the number of holes that have been closed to establish a level of activity before control.

To assess activity level after control, wait at least a week after using a burrow builder. Reopen the holes that were flagged before control. Return the following day to count closed holes. You can assess the level of control by using the following formulas:

$$\frac{\text{Number of Holes Closed by Gophers Precontrol}}{\text{Number of Holes Opened by Operator Precontrol}} = \text{Activity Level Precontrol}$$

$$\frac{\text{Number of Holes Closed by Gophers Postcontrol}}{\text{Number of Holes Opened by Operator Postcontrol}} = \text{Activity Level Postcontrol}$$

$$\frac{\text{Activity Level Precontrol} - \text{Activity Level Postcontrol}}{\text{Activity Level Precontrol}} \times 100 = \% \text{ Reduction in Activity}$$

You can count new mounds in a given area both before and after control, but this is less accurate than the open hole or mound scraping methods discussed above.

Indirect Control Methods

Pocket gophers prefer alfalfa and plants that contain high levels of moisture. Gophers can easily enter alfalfa fields, irrigated lawns, and orchards from adjacent native range or pasture. Plant a buffer strip of grain around areas that need protection. Rotate susceptible crops with annual grains to disrupt the perennial supply of food for pocket gophers. For alfalfa, varieties with fibrous roots may withstand the impacts of gophers better than varieties with a single taproot, and may be less desirable as a food source.

Flood irrigation in heavy soils discourages pocket gophers by causing soil to stick to their claws and fur. The high soil moisture also draws heat out of their bodies and limits the exchange of oxygen and other gases between burrows and soil. Unless the crop normally requires it, flood irrigation should not be undertaken because of high expense and low efficiency as a method of controlling pocket gophers.

Remove weeds that have large roots that are attractive to gophers. Most species of trees and shrubs have roots palatable to pocket gophers. If your situation allows, select plant species that have large fibrous roots rather than those with tap roots to reduce potential damage caused by pocket gophers.

Acknowledgments

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