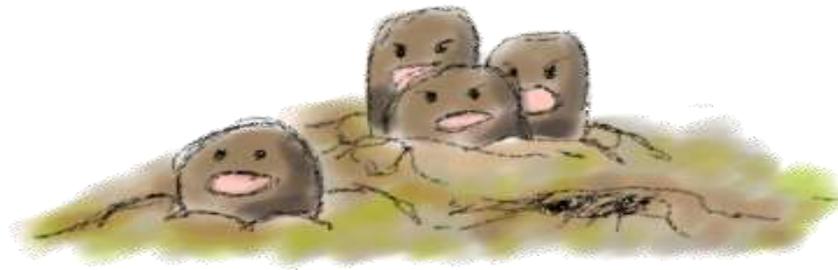




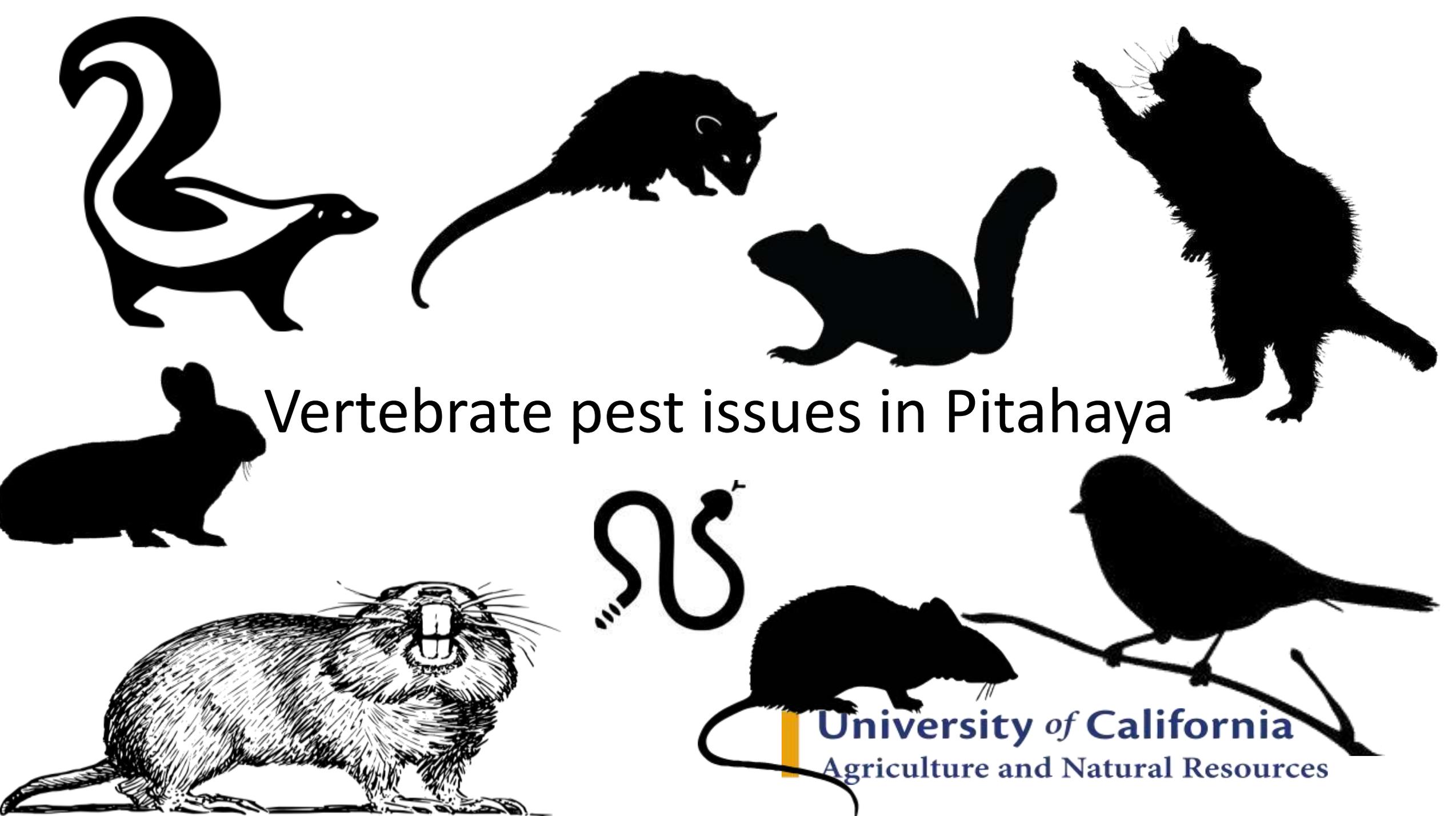
Vertebrate Pest Management for Pitahaya growers

Niamh Quinn, PhD

Human-Wildlife Interactions Advisor



University of California
Agriculture and Natural Resources



Vertebrate pest issues in Pitahaya

Today.....

- Gophers
- Squirrels
- Birds
- Rabbits



Gophers



Ed Williams, La Ag Comm.

Damage

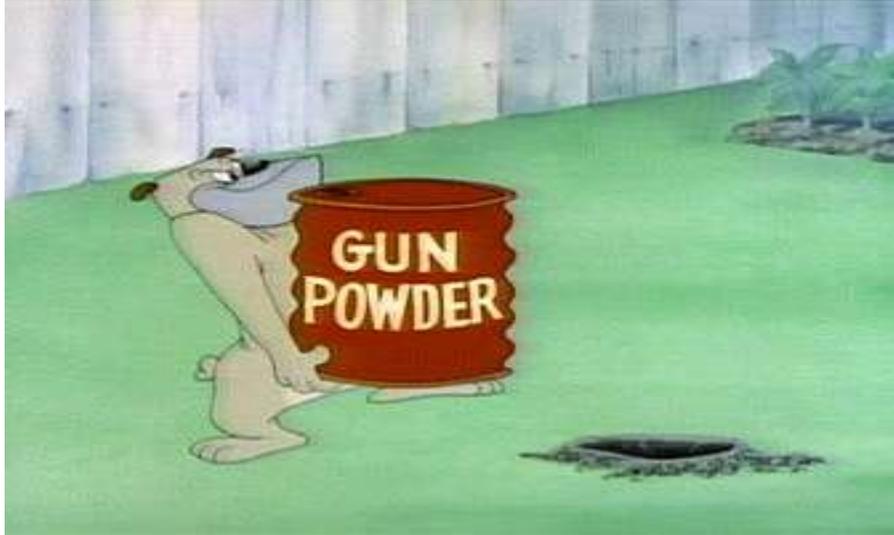
- Root damage
- Girdle plants
- Mounds are tripping hazard
- Irrigation



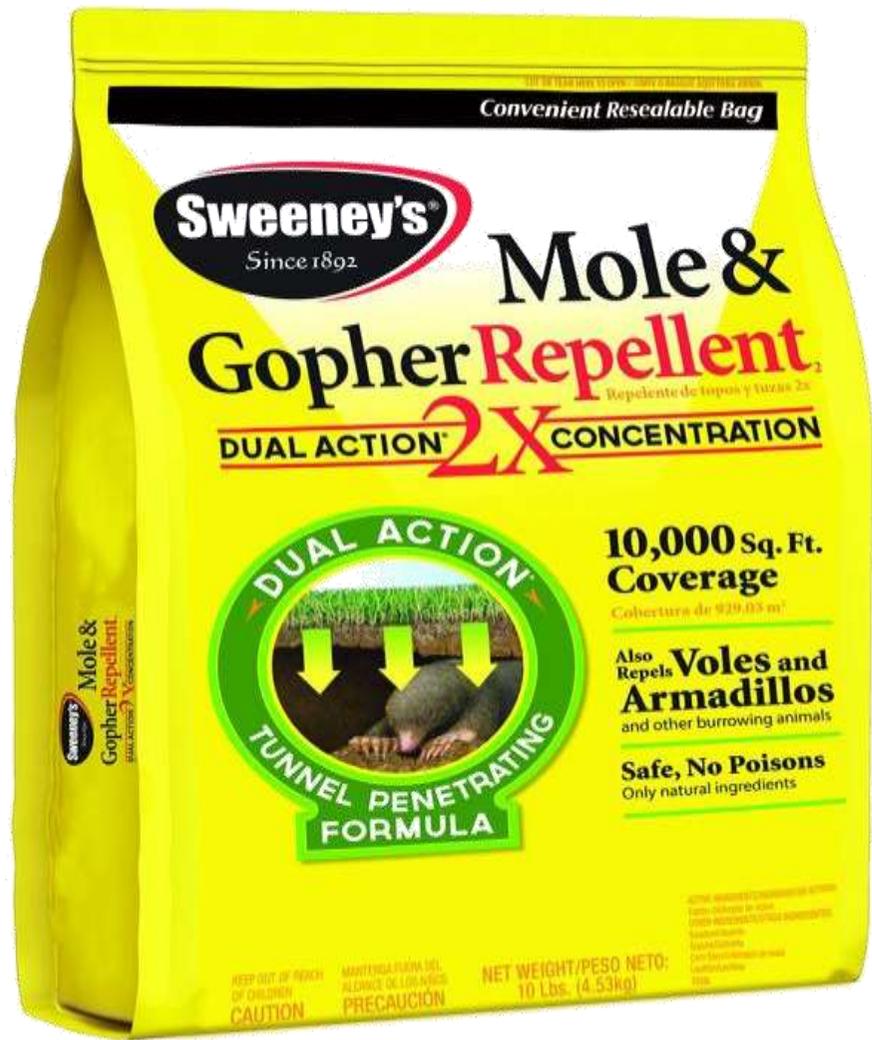
Photo courtesy of Dr. Roger Baldwin



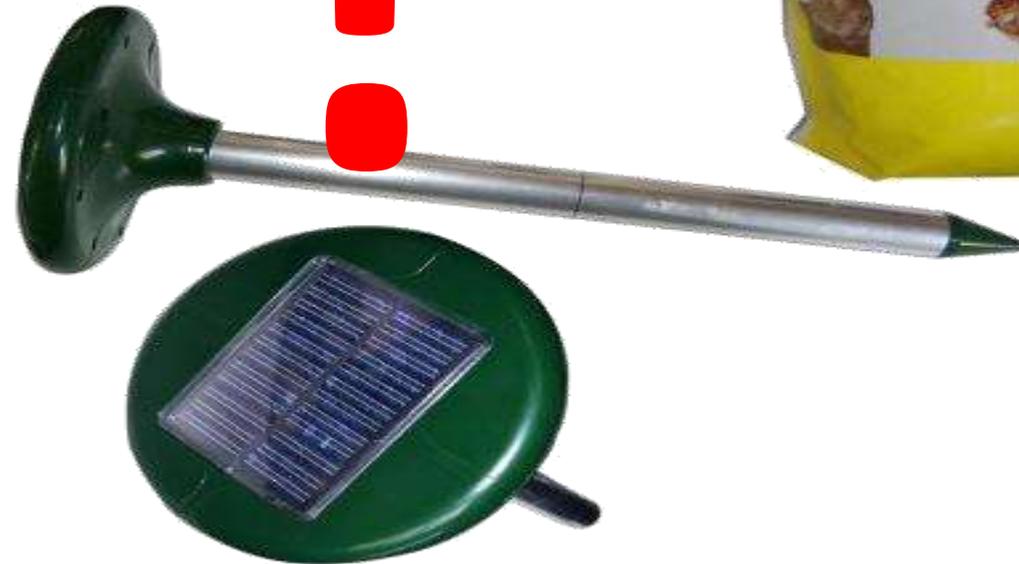
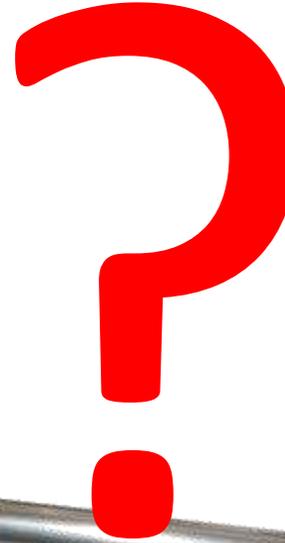
I have a gopher in my orchard! What are my options?



- Hire a PMP
- Do it yourself
 - Repellants
 - Trapping
 - Toxicants
 - Fumigation



Repellants

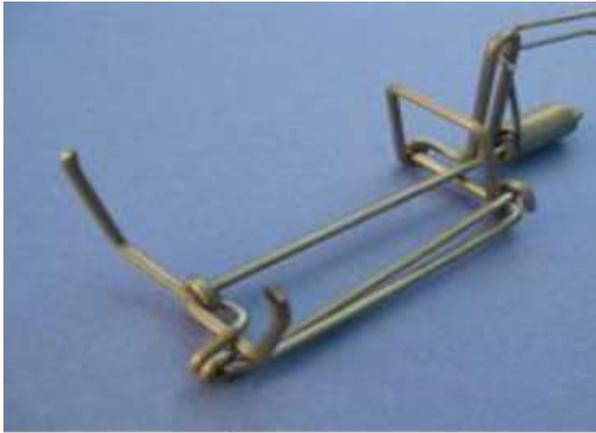


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Trapping

- Time consuming but very effective
- Best option for DIY grower
- Non-toxic method
- Economical





\$7.25



\$9.99



\$11.61

\$12.13



\$9.33



\$29.99



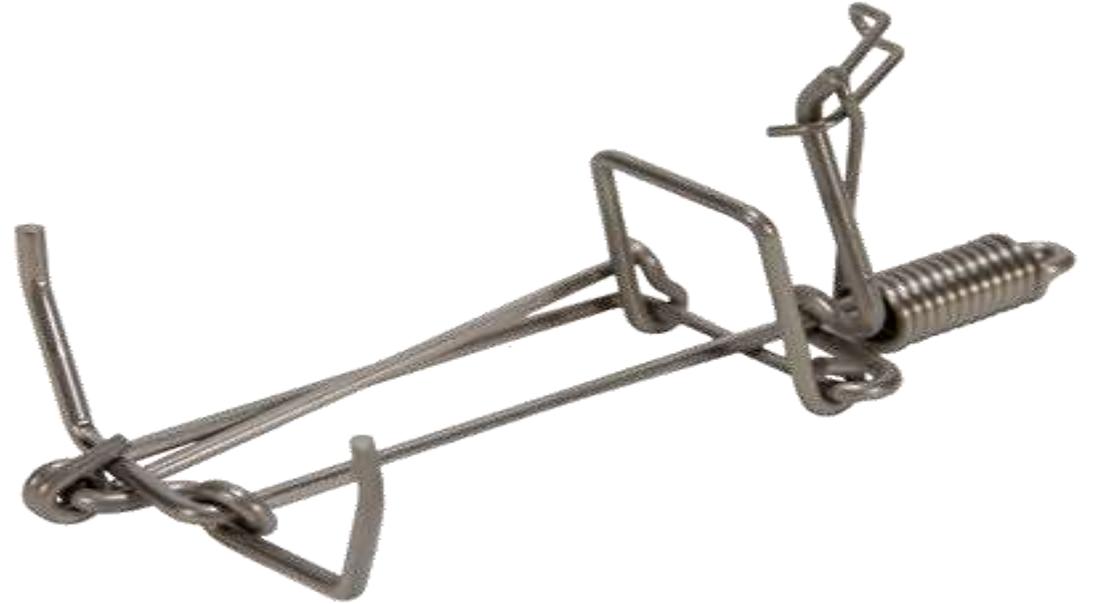
Where to purchase equipment

- Most hardware stores
- <http://www.traplineproducts.com/>
- <http://www.wildlifecontrolsupplies.com/>
- <http://store.gopherslimited.com/>

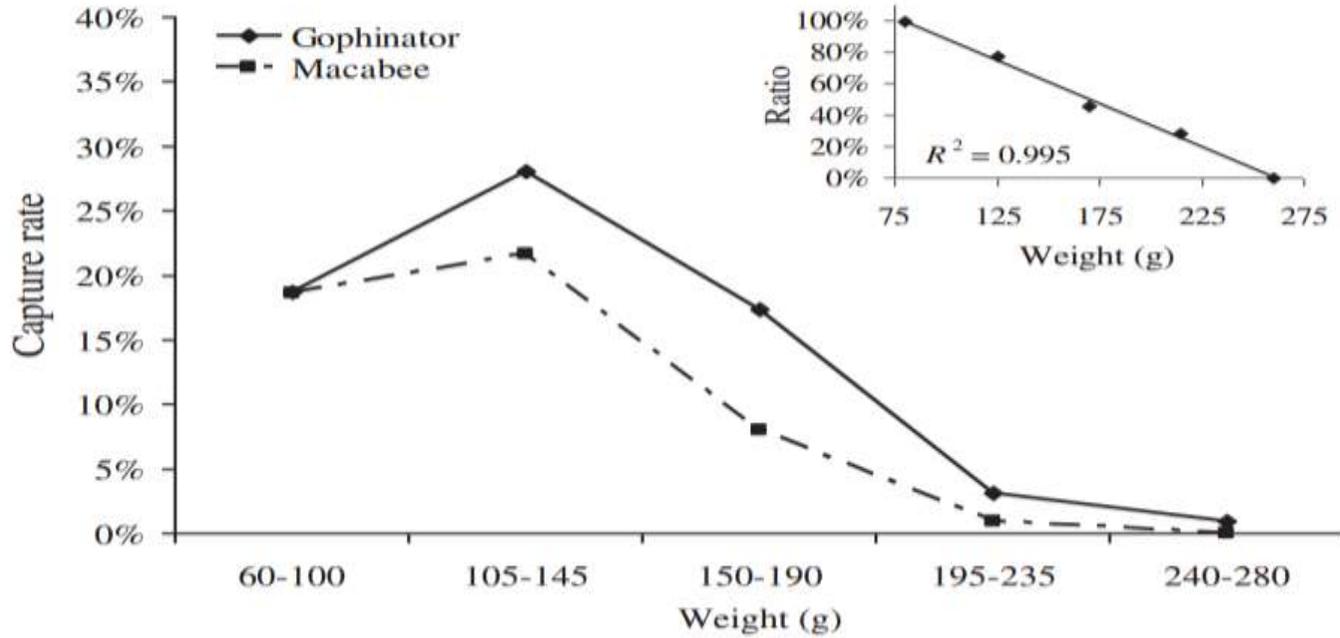
The science of trapping

- Macabee vs Gophinator
- Covered vs uncovered
- Attractant vs no attractant
- Trained vs untrained
- Gloves vs no gloves
- “above” ground traps vs “in” tunnel traps

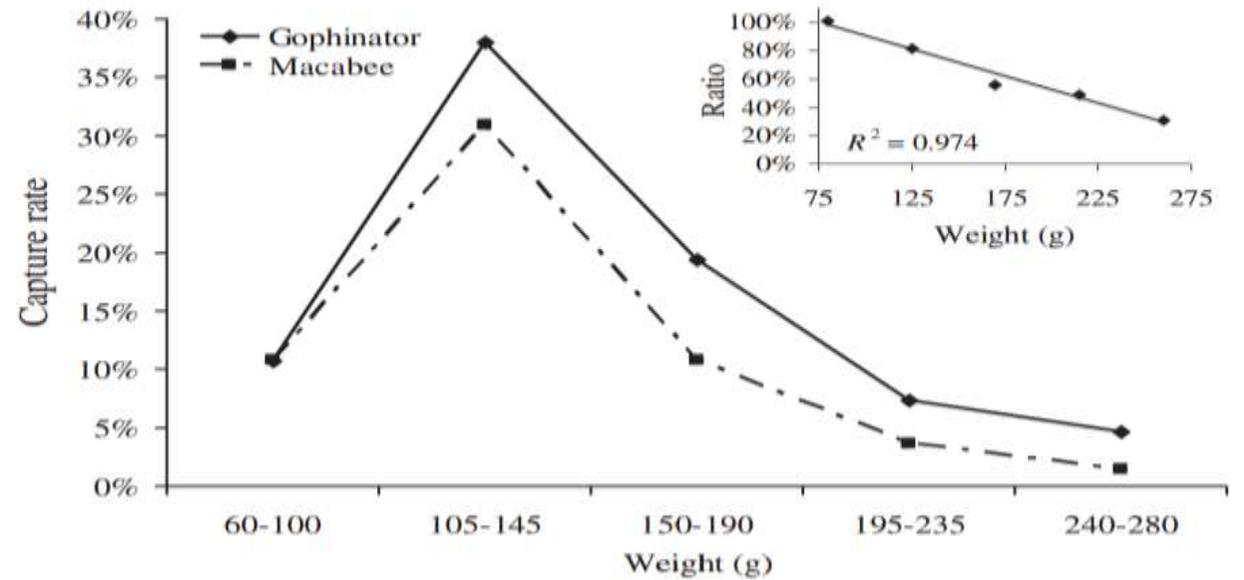
Macabee vs Gophinator



Spring--Trap Type



Autumn--Trap Type

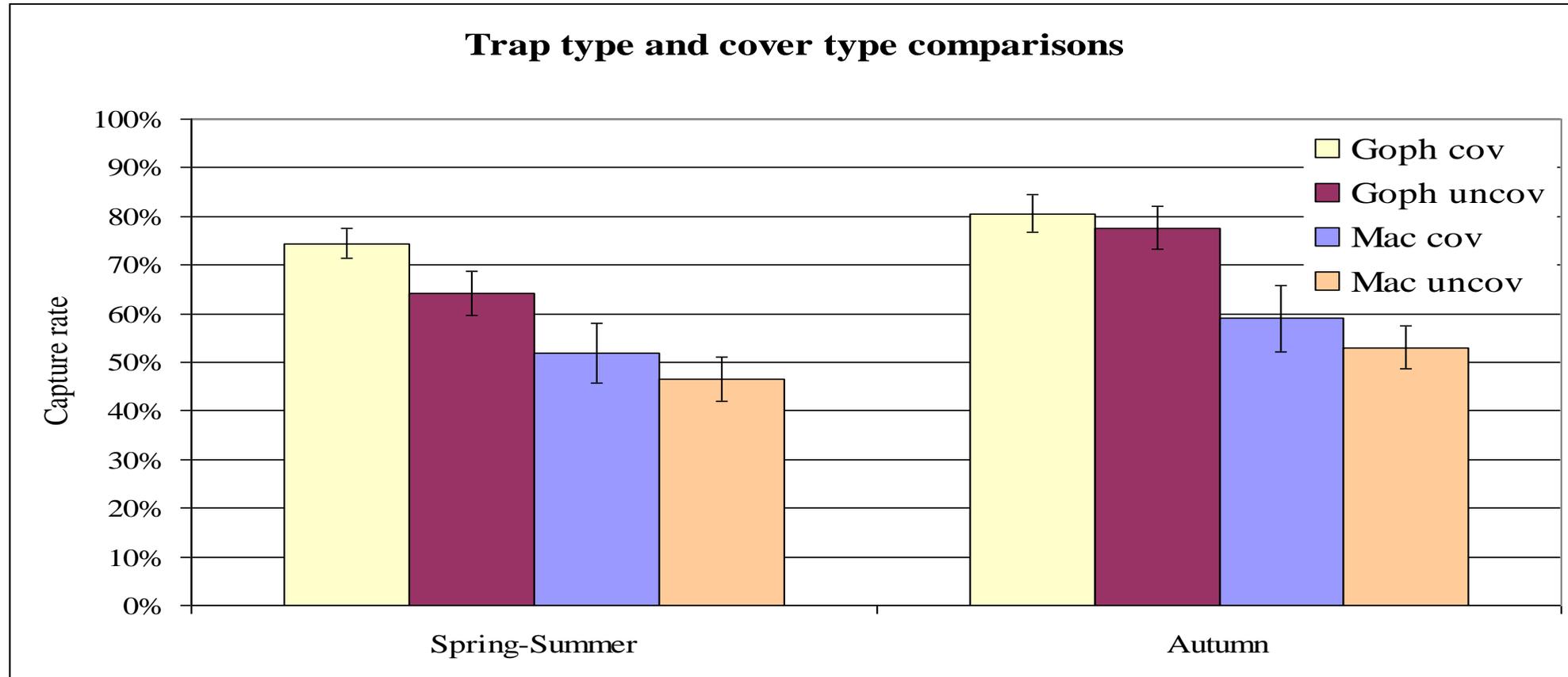


Gophinator

- Powerful trap
- Grips the animal high on the body
- Trigger arm offset to prevent upward pressure on gopher
- Rotating pincer arm that clamps to stationary arm
 - More secure capture

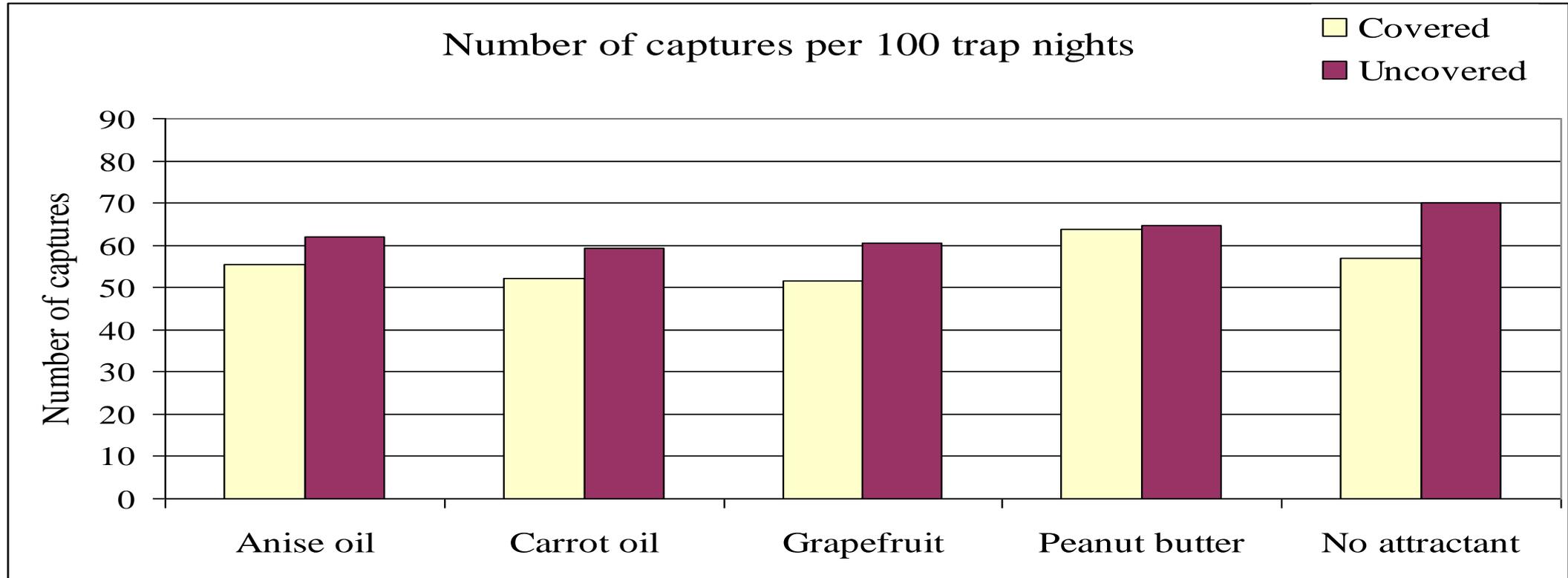
Maccabee vs Gophinator

Covered vs uncovered

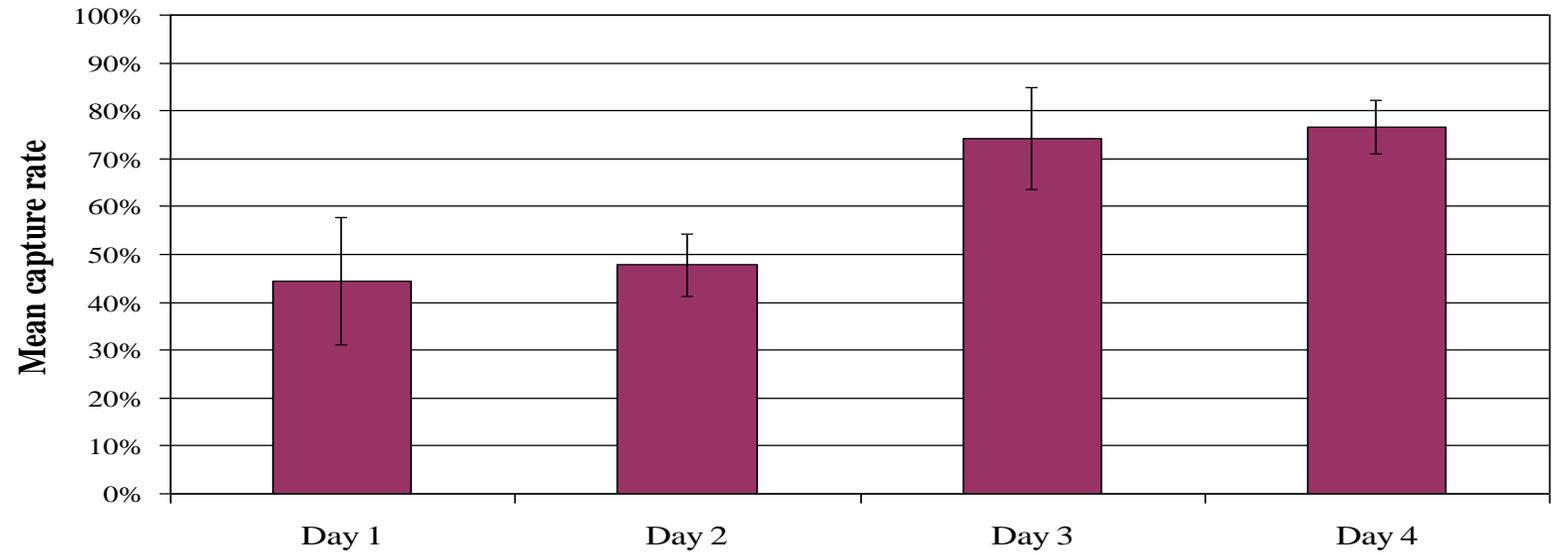
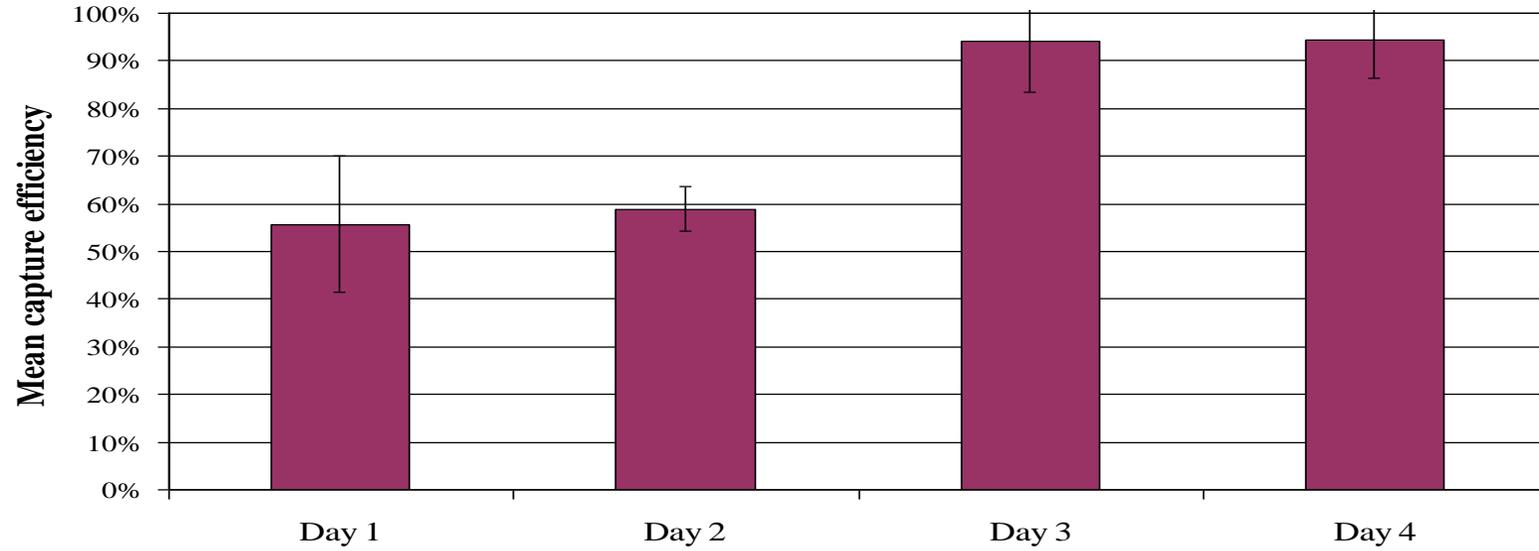


- The increase in efficacy associated with covered trap sites during spring was negated by the increased time required to set covered trap sets.

Attractant vs no attractant



Trained vs untrained



Gloves vs no gloves



Saturday :Types of trap

- Turf damage
 - Gophinator
 - Maccabee
 - Black hole and box
- Less turf damage
 - Cinch trap
 - Gopher Hawk



How do I trap?

- Materials
 - Traps
 - Probe
 - Gloves
 - Wire
 - Flags
 - Kneepads



Saturday: Technique

- Active mounds
- Probe for tunnel
 - Watch out for back-filled tunnels
- Leave probe in mound
- With hori-hori, dig hole
- Examine burrows for
 - Size
 - Turns
 - Divides



California ground squirrels



Damage

- Generally do not feed on plants
- Can dig among roots and expose plants to sun
- Irrigation





Ground Squirrel BMPs

- Biology
- Identification
- Management
- Regulations
- Resources
- FAQs



Ground Squirrel BMPs

- Biology**
- Identification
- Management
- Regulations
- Resources
- FAQs

- Range and Habitat
- Behavior and Diet
- Seasonal Activity
- Disease

Ground Squirrel Management for California



Ground Squirrel BMPs

- Biology
- Identification**
- Management
- Regulations
- Resources
- FAQs

- Signs and Characteristics
- Damage
- Look-Alike Pests
- Non-Pest Species

Ground squirrel California

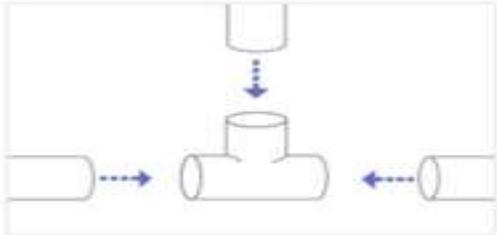


Timing Management Efforts | California Ground Squirrels



Timing and Efficacy

Compare management methods for:
 California Ground Squirrel
 Belding's Ground Squirrel



Step-by-Step Guides

- Visual how-to's for:
- Bait Station Construction
- Calculating CO2 Flow
- Spreader Calibration

Management Method Efficacy | Belding's Ground Squirrels

- Shooting
- Habitat mod.
- Biological control
- Exclusion
- Repellents

	Time of Year	Efficacy	Cost	Labor	Restrictions
Fumigation	February to April ¹	HIGH	●	●	● ²
Toxic Baits	February to May	MODERATE	●	●	●
Burrow modification	February to August	MODERATE	●	●	●
Exclusion	February to August	MODERATE	●	●	●
Shooting	February to August	MODERATE	●	●	●
Habitat modification	February to August	LOW	●	●	●
Biological control	February to August	LOW	●	●	●
Trapping	February to August	LOW	●	●	●
Repellents	February to August	LOW	●	●	●

Note: Ground

¹ Management window may be longer if high soil moisture persists, particularly following substantial irrigation.
² Dependent on which fumigant is used.

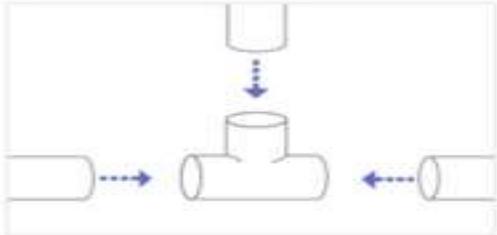
● = Low
 ● = Moderate
 ● = High



Timing and Efficacy

Compare management methods for:

- California Ground Squirrel
- Belding's Ground Squirrel



Step-by-Step Guides

- Visual how-to's for:
- Bait Station Construction
 - Calculating CO2 Flow
 - Spreader Calibration

How to Calculate CO₂ flow

1. Measure the euthanasia chamber's size in inches: **16 in × 17 in × 35 in**

2. Convert each measurement into feet. Divide each dimension by 12:
16 ÷ 12 = 1.3 ft
17 ÷ 12 = 1.4 ft
35 ÷ 12 = 2.9 ft

Multiply the three measurements together to determine the chamber's volume in cubic feet:
2.9 × 1.4 × 1.3 = 5 ft³
 The chamber size is **5** cubic ft.

Next, find the optimal flow rate range (10 to 30% of chamber volume per minute).

3. Find the lower limit of 10%.
 Multiply the chamber size (in cubic feet) by 10. Then divide by 100:

$$\frac{(5 \text{ ft}^3 \times 10)}{100} = \mathbf{0.5 \text{ ft}^3}$$

Find the upper limit of 30%.
 Multiply the chamber size (in cubic feet) by 30. Then divide by 100:

$$\frac{(5 \text{ ft}^3 \times 30)}{100} = \mathbf{1.5 \text{ ft}^3}$$

The CO₂ flow rate for a **5 ft³ chamber** should be between **0.5 and 1.5 ft³ per minute.**

Control tests on Richardson Ground Squirrels - Montana

(M. Sullins & D. Sullivan, Proc. 15th VPC, 1992)

Product	Efficacy
Rodentorch	40.6%
USDA Gas Cartridge	90.8%
Aluminum phosphide	83.7%

New technologies



Species	Device	Author	Efficacy
Belding's Ground Squirrel	PERC	Orloff	76%
California Gound Squirrel	Cheetah	Baldwin	-7%

Burrow Blocker system



Ground Squirrel Hole being filled by the Burrow Blocker.



Former Ground Squirrel Hole 1 year after being filled by the Burrow Blocker.

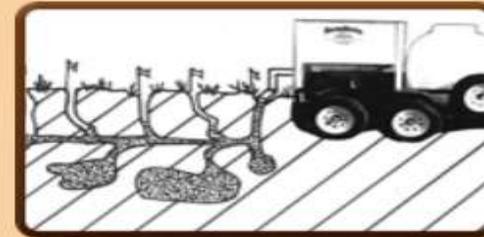


Diagram of how the Burrow Blocker effectively fills ground squirrel holes and burrows.



- Cost
- Logistics (other equipment)
- Limited site suitability

PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS AND DOMESTIC ANIMALS:

CAUTION: Harmful if swallowed or absorbed through the skin. Causes moderate eye irritation. Keep away from humans, domestic animals, and pets.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

All handlers (including applicators) must wear long-sleeved shirt, long pants, shoes, socks, and waterproof gloves. Any person who releases carcasses or trapped bait following application of this product must wear waterproof gloves.

USER SAFETY REQUIREMENTS

Follow manufacturer's instruction for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash hands thoroughly after applying bait and before eating, drinking, chewing gum, using tobacco or using the toilet and change into clean clothing.

ENVIRONMENTAL HAZARDS

This product is extremely toxic to mammals and birds. Dogs, cats and other predatory and scavenging mammals and birds might be poisoned if they feed upon animals that have eaten the bait. Do not apply directly to water, or to areas where surface water is present or to inland areas below the mean high water mark. Do not contaminate water when disposing of equipment wash water or rinsate.

STORAGE AND DISPOSAL

Do not contaminate water, food or feed by storage or disposal.

PESTICIDE STORAGE: Store only in original closed container in a cool, dry place inaccessible to children and pets. Keep containers closed and away from other chemicals. Sweep up spillage carefully and dispose of as indicated below.

PESTICIDE DISPOSAL:

Wastes resulting from the use of this product may be disposed of at on site or at an approved waste disposal facility.

CONTAINER DISPOSAL: Nonrefillable container

DO NOT REUSE OR REFILL THIS CONTAINER (Plastic). Offer for recycling or reconditioning; or puncture and dispose of in a sanitary landfill.

NOTICE: Seller makes no warranty, expressed or implied, concerning the use of this product other than indicated on the label. Buyer assumes all risk of use and/or handling of this material when such use and/or handling is contrary to label instructions.

KEEP AWAY FROM FEED AND FOODSTUFFS

WILCO DISTRIBUTORS, INC.

P.O. BOX 291 • LDMPOC CA 93438

PH# 805-735-2476

NETWT. 4 LBS.

EPA ESTB. NO.: 36029-CA-01

EPA REG NO.: 36029-20

UPC

0 91017 31004 6

220313



This product may only be used within 50 feet of buildings to control California and Townsend Ground Squirrels in California, Nevada, Oregon, Washington, Idaho, Arizona, New Mexico and Utah only. Ground Squirrel Bait by Wilco is actually impregnated by the toxicant.

Active ingredient:	
Diphacinone (CAS# 82668).....	0.005%
Other ingredients.....	99.995%
Total.....	100.00%

KEEP OUT OF REACH OF CHILDREN
CAUTION
FIRST AID

Have label with you when obtaining treatment advice.

If swallowed:	<ul style="list-style-type: none">• Call a poison control center, doctor or 1-800-856-7378 immediately for treatment advice.• Have person sip a glass of water if able to swallow.• Do not induce vomiting unless told to do so by a poison control center or doctor.
If on skin or clothing	<ul style="list-style-type: none">• Take off contaminated clothing.• Rinse skin immediately with plenty of water for 15-20 minutes.• Call a poison control center or doctor immediately for treatment advice.
If in eyes:	<ul style="list-style-type: none">• Hold eye open and rinse slowly and gently with water for 15-20 minutes.• Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eyes.• Call a poison control center or doctor immediately for treatment advice.

TREATMENT FOR PET POISONING

If animal eats bait, call a veterinarian or 1-800-252-1222 at once.

NOTE TO PHYSICIAN OR VETERINARIAN

Contains the anticoagulant Diphacinone. If swallowed, this material may reduce the clotting ability of the blood and cause bleeding. For humans or animals ingesting bait and/or showing poisoning signs (bleeding or elevated prothrombin time), give vitamin K1 intramuscularly or orally.

DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

READ THIS LABEL: Read this entire label and follow all use directions and use precautions. Use only for the sites, pets, and application directions described on this label.

IMPORTANT: Do not expose children, pets, or other nontarget animals to rodenticides. To help prevent accidents.

1. Store product not in use in a location out of reach of children, pets, and livestock.
2. Apply this product in secured, tamper-resistant bait stations, (like Wilco Ground Squirrel Bait Stations). These stations must be resistant to destruction by dogs and by children under six years of age, and must be constructed and used in ways which prevent such children from reaching into bait compartments and obtaining bait. Stations must be secured so that they cannot be overturned by young children, pets, or winds. Stations used in areas open to livestock and/or nontarget wildlife must be secured so that the units cannot be readily overturned by any nontarget animals that have access to them.
3. Dispose of product container, and unused, spoiled, and unconsumed bait as specified on this label.

USE RESTRICTIONS: For use only around buildings (including yards and flower gardens) in secured, tamper-resistant bait stations (like Wilco Ground Squirrel Bait Stations) to control the California Ground Squirrel (*Spermophilus beecheyi*) and Townsend Ground Squirrel (*Spermophilus townsendi*) in California, Nevada, Oregon, Washington, Idaho, and New Mexico, Utah only.

Do not apply this product by any method not specified on this label. This product may not be broadcast. Do not sell this product in individual containers holding less than 4 pounds of bait.

APPLICATION DIRECTIONS: Secure bait stations at locations where they will be readily accessible to target ground squirrels, preferably near active burrows. Secure stations 20 to 100 feet apart, depending upon density of the population. Wear waterproof gloves and scooping device (preferably long-handled) to transfer bait from the container to the station. Use 2 to 4 pounds of bait per bait station. Check bait stations frequently to insure that an uninterrupted supply of bait is always available for at least 15 days or until signs of feeding have stopped.

POST-APPLICATION DIRECTIONS:

Wearing waterproof gloves, collect and bury dead rodents. Dispose of leftover bait according to "Pesticide Disposal". With detergent and hot water, wash all implements used for applying bait. Do not use these implements for mixing, holding, or transferring foods or feed.



Rabbits

- Not generally a problem for mature plants
- Can eat young plants
- May lead to death of plant

Fencing



- Long-term and effective
- Poultry netting (chicken wire) supported by light stakes will provide adequate control
- Mesh size should be no larger than 1 inch in order to exclude young rabbits.
- Use 48-inch-tall wire
- Bury the bottom at least 6 to 10 inches into the ground
- Bend a few inches of the fence bottom outwardly
- Bury the bottom of the wire fence OR stake the bottom edge to deter rabbits from passing beneath it

- Use tight-fitting gates with sills to keep rabbits from digging below the bottom rails
- Keep gates closed as much as possible
- Inspect the fence regularly to make sure rabbits or other animals haven't dug beneath it
- Cottontails and brush rabbits won't jump a 2-foot fence
- Jackrabbits ordinarily won't jump a 2-foot fence unless a dog chases them, or they become otherwise frightened
- Discourage jumping by increasing the above-ground height to 3 feet



Birds

- Damage directly to fruit
- Reduces marketable yield
- Health and safety risk



Netting

- Bird netting is pretty much essential
 - Individual trees
 - Entire groves
- Can be costly
- If done correctly it can last multiple growing seasons and be very effective



- When covering individual trees it is important to ensure that the netting is not touching the fruit
- That the plant is completely enclosed in the netting and gathered at the bottom
- Tie securely at the trunk at the bottom of the tree
- Use PVC pole to help extend netting



Photo courtesy of Chuck Ingles

Protecting individual fruits?



- Might work
- Not generally suitable
- Vertebrate pests are very persistent

Entire groves



Be vigilant-make repairs!



Don't leave the door open!





Questions

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