Ground Squirrel Management

Bait Strategies and Compliance

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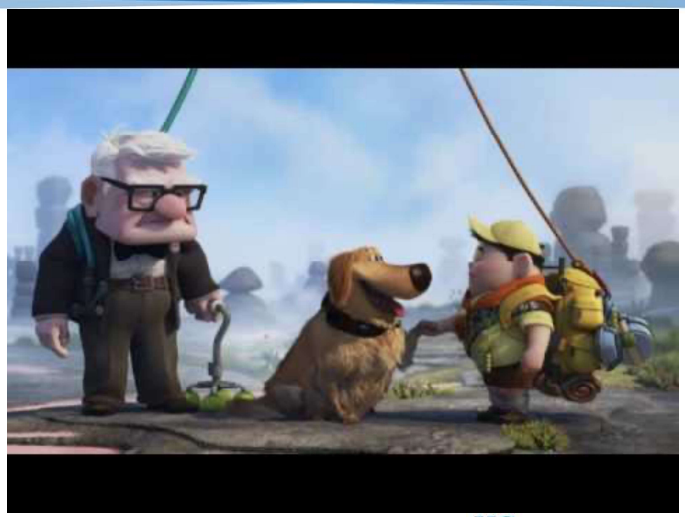
First thing – SQUIRREL!!!



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Why Care?

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But first – SQUIRREL!

Visual Count Index Record

Plot ID: _____ Date _____

This is a minimal-, low-, medium-, or high-density plot: _____

Study Day Number: _____

Morning survey: Time of sunrise: _____Time of arrival at plot: _____

Temperature: _____ wind: _____ sky: _____

Observation location: (Mark or flag location for repeatability) _____

Scan 1 time begin: _____ Scan 1 count: _____

Scan 2 time begin: _____ Scan 2 count: _____

Scan 3 time begin: _____ Scan 3 count: _____

Scan 4 time begin: _____ Scan 4 count: _____

Scan 5 time begin: _____ Scan 5 count: _____

Wildlife observed /notes: _____

_____

_____

Performed by: _____ Date: _____

Evening survey: Time of sunset: _____ Time of arrival at plot: _____

Temperature: _____ wind _____ sky: _____

Observation location: (Mark or flag location for repeatability) _____

Scan 1 time begin: _____ Scan 1 count: _____

Scan 2 time begin: _____ Scan 2 count: _____

Scan 3 time begin: _____ Scan 3 count: _____

Scan 4 time begin: _____ Scan 4 count: _____

Scan 5 time begin: _____ Scan 5 count: _____

Official result for the day is the highest number of squirrels recorded at either the morning or evening survey: _____

Wildlife observed /notes: _____

_____

_____

Performed by: _____ Date: _____

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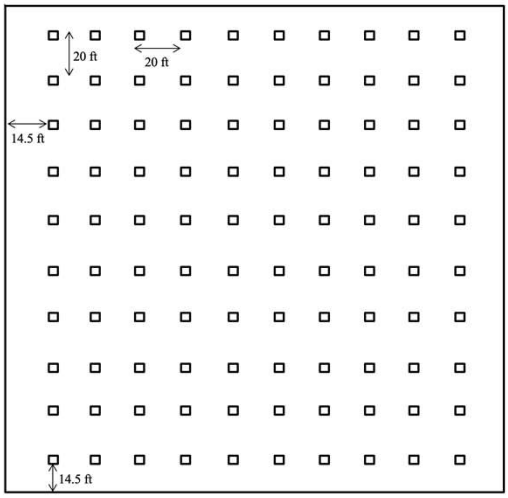
Why Care?

Comparative Yield Plot Layout



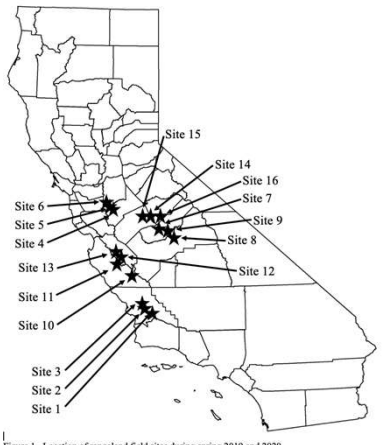


Figure 1. Location of rangeland field sites during spring 2019 and 2020.

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Why Care?

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Bait Strategies

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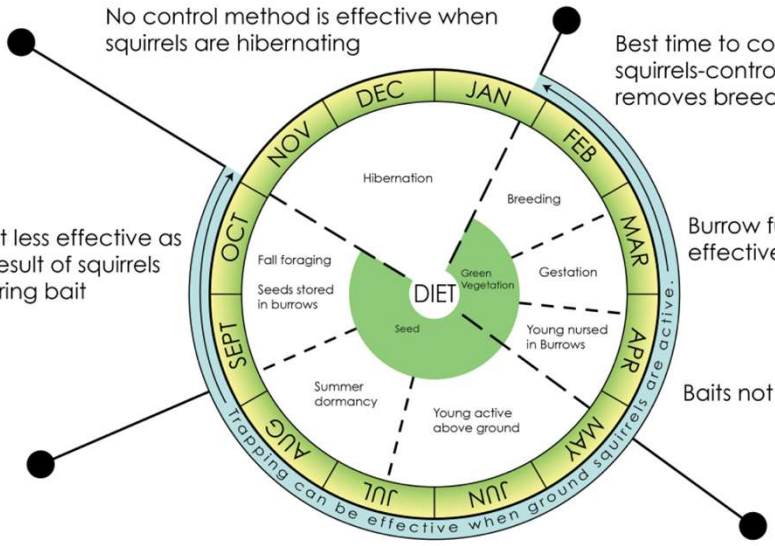
California Ground Squirrel - Calendar of Management



From: University of California Ground Squirrel BMP website: http://groups.ucanr.org/GSBMP/index.cfm

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Bait delivery options

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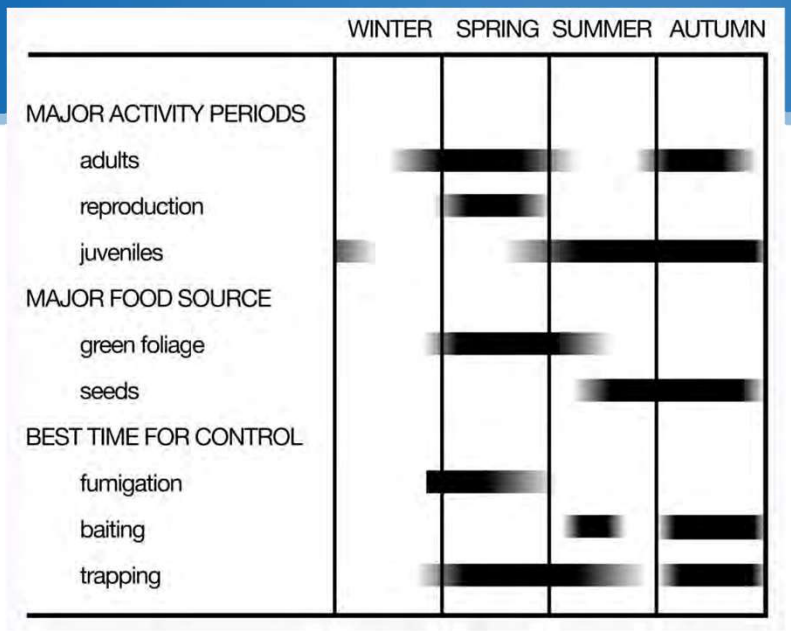
Timing



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Trapping

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Bait

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Fumigation

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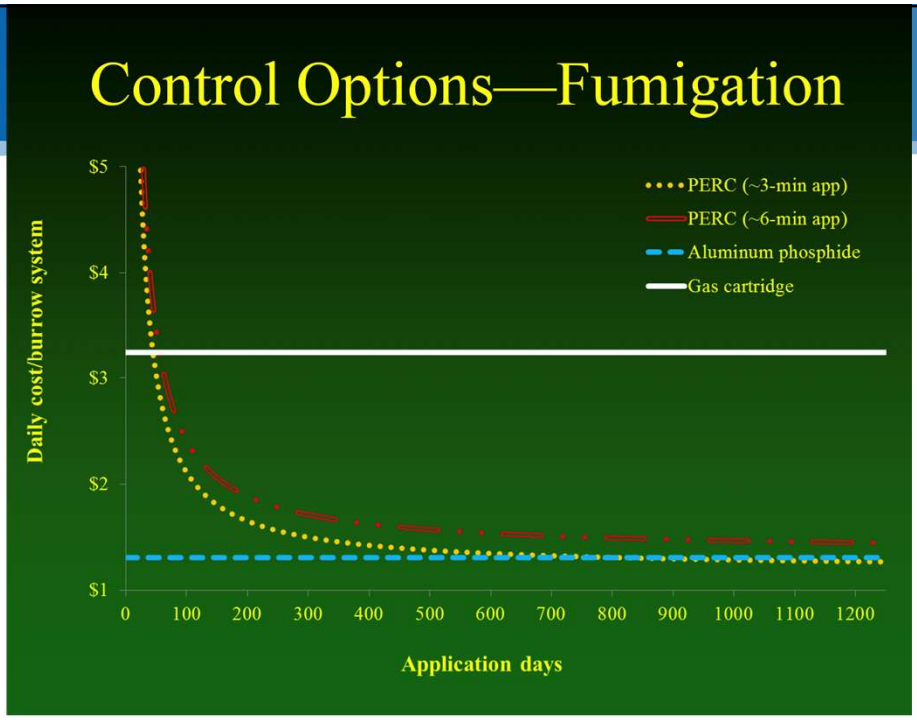
Control Options—Fumigation



Cooperative Extension

Shooting

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Case Study Example

- Large population in a vineyard
- Initiate control after harvest
- Certified Applicator
- No endangered species present

Case Study Example

- Possible plan:
  - Zinc phosphide in autumn
  - Aluminum phosphide in spring
  - Anticoagulant bait station or trapping in summer

BUT Wait – Secondary Kill?

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Secondary Kill potential

- Secondary toxicity may vary (diphacinone)
  - whole body residues
    - ➢spot treatment = 0.23 mg/kg
    - ➢broadcast application = 0.41 mg/kg
    - ➢bait station = 0.91 mg/kg

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Secondary Kill potential

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    - ➢broadcast application = 0.41 mg/kg
    - ➢bait station = 0.91 mg/kg

- Study limitations:
  - small sample sizes for some (*n* = 8, 34, 7, respectively)
  - collected from multiple studies (Baroch 1994, Salmon 2002)
  - somewhat biased sample collection
  - was never published

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Secondary Kill Potential

1. Determine residual concentrations of Rodent Bait Diphacinone Treated Grain (0.005% and 0.01%) via three application strategies.
2. Determine if time to death varied for differing application strategies.
3. Determine proportion that died below ground for differing application strategies.

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Secondary Kill Potential

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Secondary Kill Potential

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Secondary Kill Potential – Amount of Bait Applied (lbs)

	Bait station		Spot		Broadcast	
	Ranch 1	Ranch 2	Ranch 1	Ranch 2	Ranch 1	Ranch 2
App 1	128.0	128.0	11.6	10.8	3.7	3.6
App 2	21.3	8.1	12.0	11.2	3.8	3.5
App 3	-----	4.1	-----	-----	-----	-----
Remaining	4.8	19.9	-----	-----	-----	-----
Total	144.5	120.3	23.6	22.0	7.5	7.1

	Bait station		Spot		Broadcast	
	Ranch 3	Ranch 4	Ranch 3	Ranch 4	Ranch 3	Ranch 4
App 1	128.0	128.0	13.6	12.6	4.3	3.8
App 2	18.2	13.4	11.8	13.9	4.1	3.9
App 3	12.1	22.0	-----	-----	-----	-----
Remaining	10.1	11.5	-----	-----	-----	-----
Total	148.2	151.9	25.4	26.5	8.4	7.7

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Secondary Kill Potential - Efficacy

	Control			Bait station			Spot treatment			Broadcast		
	Censored	Mortality	Efficacy	Censored	Mortality	Efficacy	Censored	Mortality	Efficacy	Censored	Mortality	Efficacy
Gallo 1	0	0/7	0%	2	5/5	100%	2	5/5	100%	3	0/4	0%*
Gallo 2	0	0/7	0%	1	6/6	100%	5	2/2	100%	4	3/3	100%
Gallo 3	0	0/4	0%	2	6/6	100%	2	6/6	100%	2	0/6	0%
Gallo 4	0	0/4	0%	5	3/3	100%	2	6/6	100%	4	4/4	100%
Comb	**0**	**0/20**	**0%**	**10**	**20/20**	**100%**	**11**	**19/19**	**100%**	**13**	**7/17**	**41%**

* Used 0.005% diphacinone bait

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Secondary Kill Potential – Time from Application to death

	Bait station		Spot		Broadcast	
	Mean	Range	Mean	Range	Mean	Range
Summer	8.5	5-16	9.4	6-12	-----	-----
Autumn	10.0	4-19	11.0	4-17	8.1	5-11
Mean	**9.2**	**4-19**	**9.4**	**4-17**	**8.1**	**5-11**

$F_{2,42} = 0.3, P = 0.724$

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Secondary Kill – Carcass Location

	Below ground	Above ground	Percentage	Potentially scavenged	Adjusted percentage
Summer	19	3	86%		
Autumn	23	1	96%		
Total	**42**	**4**	**91%**		

Unadjusted: Fisher's exact *P* = 0.336

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Secondary Kill – Carcass Location

	Below ground	Above ground	Percentage	Potentially scavenged	Adjusted percentage
Summer	19	3	86%	0	86%
Autumn	23	1	96%	4	82%
Total	**42**	**4**	**91%**	**4**	**84%**

Unadjusted: Fisher's exact *P* = 0.336

Adjusted: Fisher's exact *P* = 1.000

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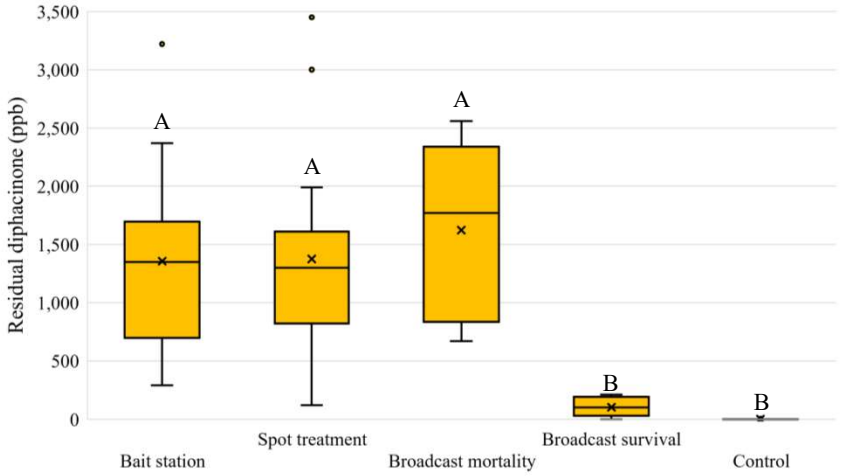
Secondary Kill – Residual Diphacinone



$F_{4,61} = 19.9, P < 0.001$

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What does this mean?

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Do Daily Searches Work?

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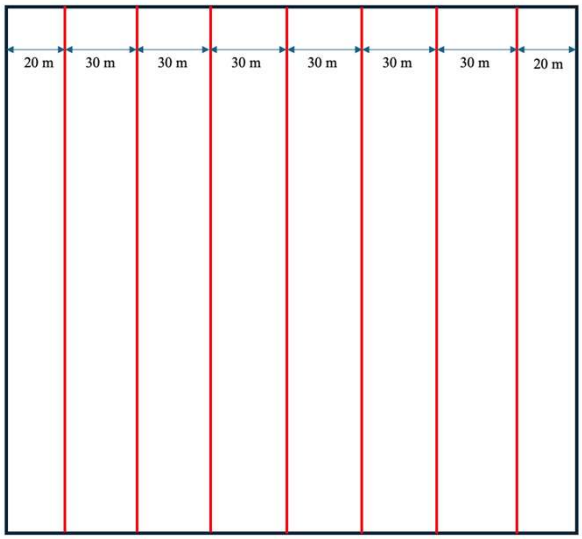
Daily Searches



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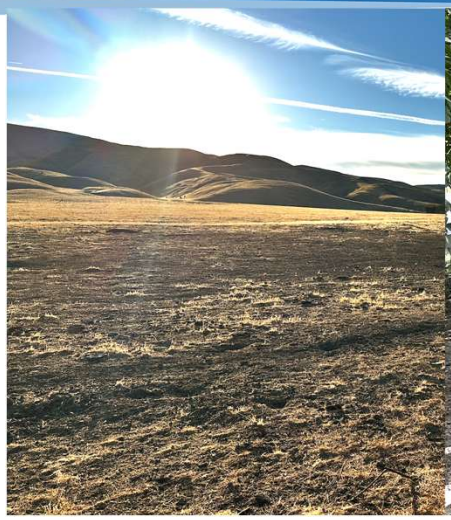
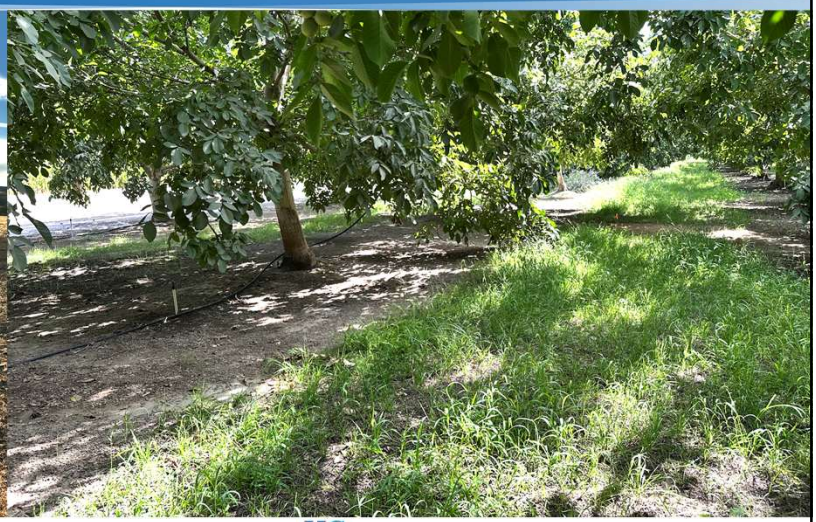
Daily Searches





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Daily Searches

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Daily Searches

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Compliance

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Now what?

- AB 1322, January 2024
  - Diphacinone
- AB 2552, January 2025
  - Chlorophacinone and warfarin

ALL RESTRICTED USE!

Ag still able to use them.
For now.

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Questions?

https://baldwin.ucdavis.edu

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