Systems Approach to Pest Management Practices - Potted Foliage

Farm Bill Update
Cooperating Nurseries
August 2, 2012
Part 2

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AGENDA

- Status of Pest Concerns at Cooperating Nurseries.
- Confirming Pest Identification. (see Part 1)
- Current Pest Management Strategies.
- Updates on Pest Control Strategies.
- The Next Step: Developing Integrated Pest Management Practices.
- Discussion and Questions.

Presenters:

Principal Investigator: Arnold Hara
Jorden Zarders
Susan Cabral
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Ruth Niino-DuPonte

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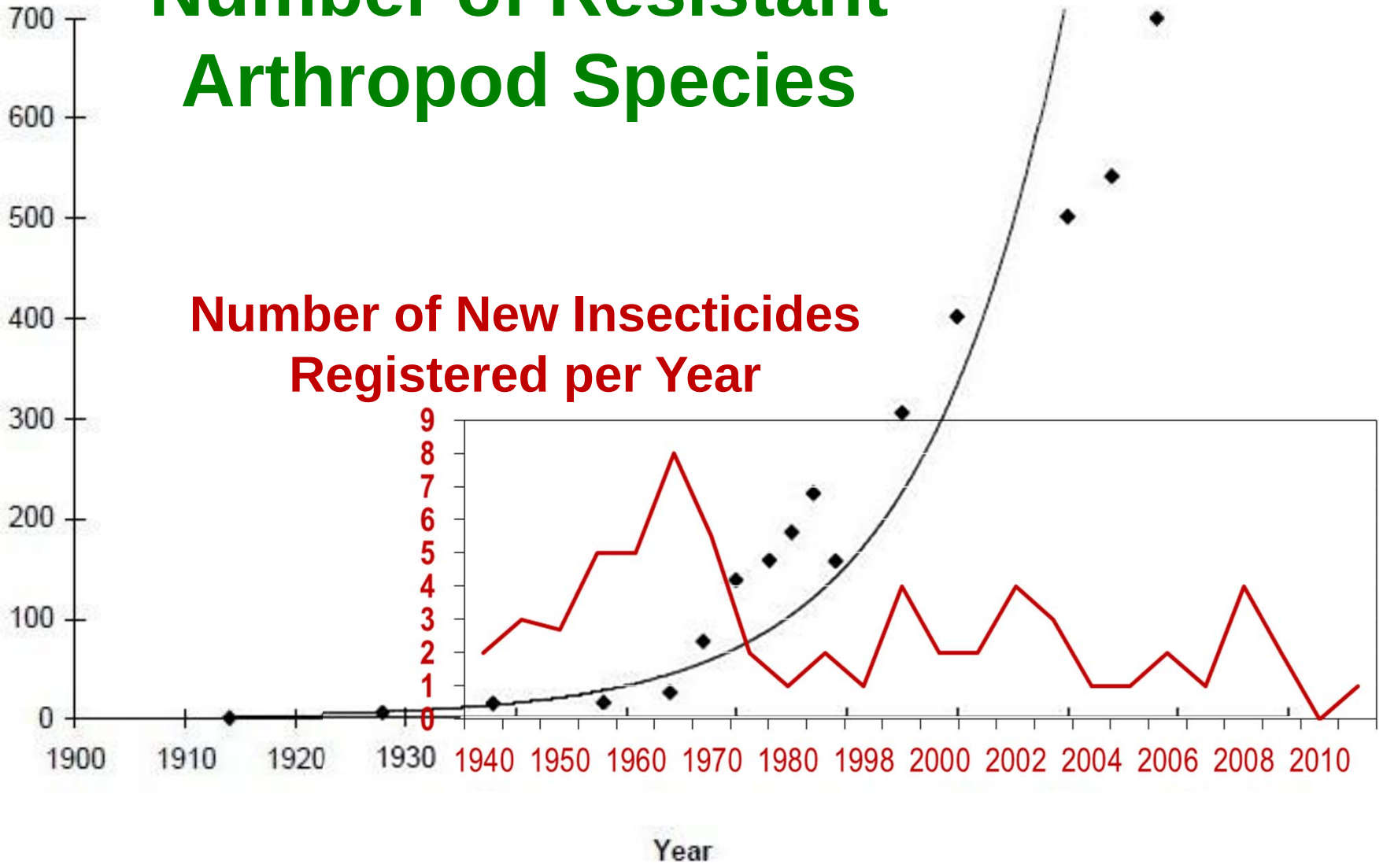
Pesticide Rotations to Prevent Resistance

Number of Resistant Arthropod Species



Sources: J.R.M. Thacker. 2002. An Introduction to Arthropod Pest Management.
US EPA. 2012. www.epa.gov/opprd001/factsheets

Insecticide Resistance Action Committee
www.irac-online.org

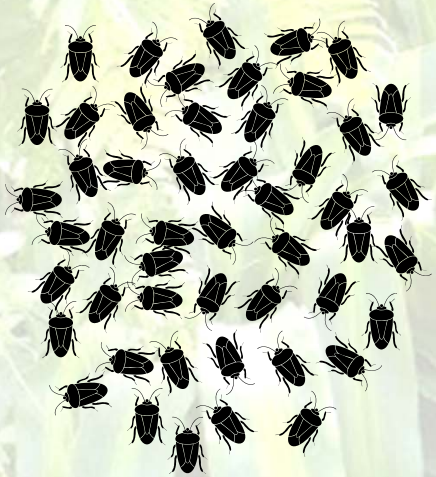
Purpose: Established in 1984 to prevent or delay the development of resistance in insect and mite pests

What is resistance?

a **genetic change** in the sensitivity of a pest population, which is **passed on** to the next generation, that results in **repeated failure** of the product to achieve control **as expected** when used **according to the label** for that pest species.

DEVELOPING RESISTANCE TO PESTICIDES

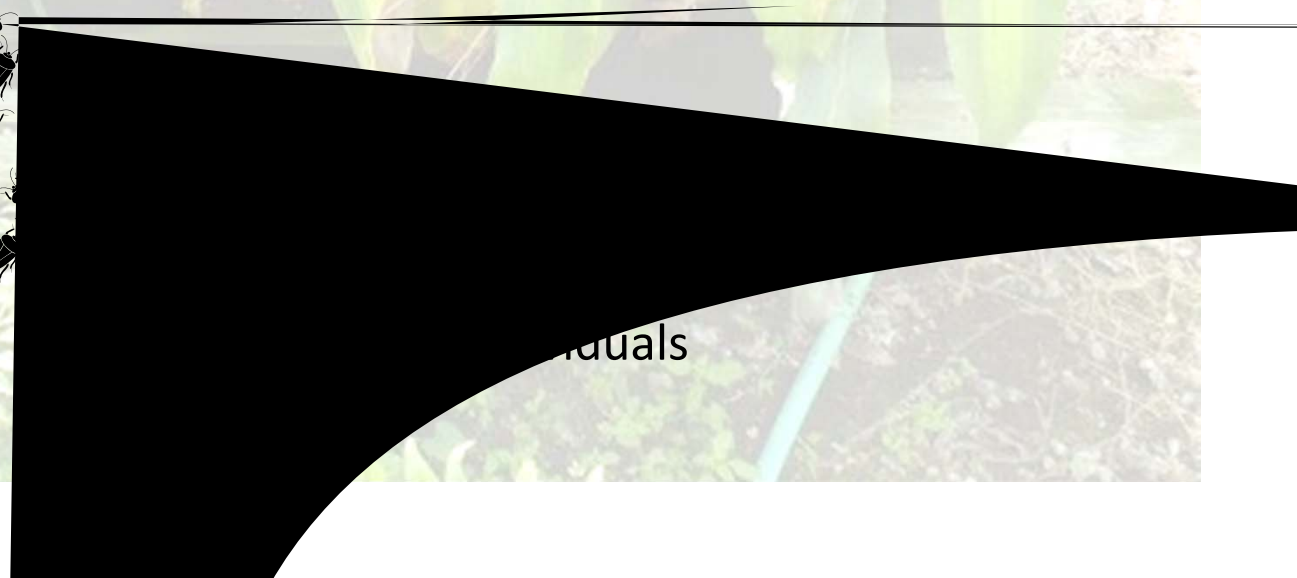
1 First few applications kill nearly all pests



2 A random mutation allows a few individuals to survive ( ) and reproduce

3 While some are still killed by the pesticide, more individuals survive and multiply

Numbers of beneficial insects may also be reduced by the pesticide, which can contribute to higher numbers of pests.



Classes 1-6, 9, 14, 19, 22, and 28 (Yellow) target nerves and muscles.
Classes 7, 10, 15-18, and 23 (Blue) target growth and development.
Classes 12, 13, 20, 21, 24 and 25 (Red) interferes with energy metabolism.
Classes 8, 11, and 29 have miscellaneous modes of action.

How can I avoid causing resistance?

IRAC Resistance Management Strategy

- Rotate among **different classes** of chemicals with **different Modes of Action**
- Use the **same** insecticide for **2 or 3 applications** depending on the specific pest's generation time before switching to another chemical. Do not wait until insects become resistant before switching to another chemical or may cause insects to develop resistance to multiple classes of chemicals.
- Incorporate other **non-chemical** control methods (physical, cultural, biological) to manage insect pests.

Commonly Used Pesticides by Nursery Cooperators

Group	Primary Target Pests	Chemical Group	Active Ingredients	Trade Names
1A	Caterpillars,soft scales,Thrips	Carbamates	Carbaryl	Carbaryl
		Carbamates	Methiocarb	Mesurol
1B	Aphids, Caterpillars, Mealybugs, Ants, whiteflies, Fungus Gnats	Organophosphate	Dimethoate	Dimethoate
		Organophosphate	Chlorpyrifos	Dursban
		Organophosphates	Acephate	Precise
		Organophosphates	Mercaptomethyl	Imidan
		Organophosphates	Acephate	Orthene
		Organophosphates	Acephate	Acephate 97 UP
		Organophosphates	Chlorpyrifos	Lorsban
3A	Aphids, Caterpillars,Mealybugs, Thri Mealybugs, Thrips, Scales	Pyrethoid	Cyfluthrin	Decathlon
		Pyrethoid	Cyfluthrin	Discus
		Pyrethoid	Bifenthrin	Talstar
4A	Aphids, Whiteflies, Grubs, Scales, Mealybugs, Thrips, Caterpillars, Midges	Neonicotinoids	Imidacloprid	Merit 75 wp
		Neonicotinoids	Imidacloprid	Marathon
		Neonicotinoids	Imidacloprid	Provado
		Neonicotinoids	Imidacloprid	Merit
		Neonicotinoids	Dinotefuran	Safari
5	Catterpillars, Mites, Thrips	Spinosyns	Spinosad	Conserve
6	Mites, Thrips	Avermectins	Abamectin	Abamectin E. Pro 0.15 EC
	Mites	Glycosides	Abamectin	Avid
7A	Imported Fire Ants	Juvenile Hormone Analogues	Methoprene	Extinguish
		Juvenile Hormone Analogues	Methoprene	Tango
7B	Fungus Gnats, Shore Flies	Pyridine insect growth regulator	Pyriproxyfen	Distance
10A	Mites	Tetrazines	Clofentezine	Ovation
11B2	Caterpillars	Biopesticide	Bacillus thuringiensis, subsp. Kurstaki	Dipel
12B	Mites	Organotin miticides	Fenbutatin-oxide	Promite
13	Mites, Thrips, Fungus Gnats, Foliar Nematodes, Caterpillars	Pyrroles	Chlorfenapyr	Pylon
16	Mealybugs, Whiteflies	Buprofezin	Buprofezin	Talus
20A	Imported Fire Ants	Hydramethylnon	Hydramethylnon (s-methoprene)	Extinguish Plus
		Hydramethylnon	Hydramethylnon	Amdro
23	Aphids, Leafhoppers, Mealybugs, Psyllids, Whiteflies, Mites	Tetronic acids	Spirotetramat	Kontos
		Tetronic acids	Spirotetramat	Movento
25	Spider Mites	Carbazate	Bifenazate	Floramite
UN	Slugs, Snails	Aldehyde	Metaldehyde	Slugfest, Deadline, Metarex
UN	Mites, Mealybugs, Aphids	Oils	Petroleum oil	PureSpray, Ultra-Fine

Granular Insecticide in Plant Media

CALCULATING BIFENTHRIN GRANULAR INSECTICIDE INCORPORATION INTO POTTING MEDIA

Andrew Kawabata August 2, 2012
University of Hawaii CTAHR-CES

United States Department of Agriculture

Animal and Plant Health Inspection Service

Program Aid No. 1904

Imported Fire Ant 2007:

Quarantine Treatments for Nursery Stock and Other Regulated Articles

http://www.aphis.usda.gov/publications/plant_health/content/printable_version/IFA2007.pdf

Approved pesticides for quarantine treatment for Fire Ant Treatment in nursery stock per USDA Plant Protection Section

- **Bifenthrin** – Talstar, Up-Star, Bifenthrin Pro, Brigade, Capture, Zipac, etc.
  - 0.2% Active Ingredient
  - Incorporation of granular insecticide into Potting Media

- ~~Dursban~~ – No longer available
- Diazinon
- Fipronil – available only to Pest Control Operators
- Hydramethylnon (Amdro bait)
- Methoprene (Extinguish bait)
- Pyriproxyfen (Distance bait)
- Tefluthrin (Force – Restricted Use/? Granular)

Application Directions from the Up-Star label							
Up-Star Nursery Granular is approved under the USDA Plant Protection Imported Fire Ant Quarantine Certification Program when used in accordance with USDA guidelines. Use the recommended application rates given in the table below to obtain the length of control required for certification.							
Pest	USDA IFA		Potting Media Bulk Density (pounds per cubic yard)*				
	Certification	Application					
	Period	Rate	200	300	400	500	600
	(months)	(ppm)	(lbs. UP-Star Nursery Granular per Cubic Yard)				
Imported Fire	0 to 6	10	1	1.5	2	2.5	3
Ant	7 to 12	12	1.2	1.8	2.4	3	3.6
	13 to 24	15	1.5	2.25	3	3.75	4.5
	continuous	25	2.5	3.75	5	6.25	7.5

*Bulk Density = laboratory determined dry weight of a unit volume of potting media

Calculating Bifenthrin (Talstar/Up-Star/etc.) for Potting Media Incorporation

- Step 1: Bulk Density Determination
  - Bulk Density = dry weight of a unit volume of potting mix
  - Laboratory determination available through UH ADSC

- Submit a potting media sample to UH ADSC

  875 Komohana St. – Bldg. C Lab 4

  - ~2 cups in a clean plastic bag
  - $7.00 diagnostic cost (S3)
  - Cost of samples – covered by Systems Approach project (see Susan)

Calculating Bifenthrin (Talstar/Up-Star/etc.) for Potting Media Incorporation

- Step 2: Conversion of UH ADSC Bulk Density results

- Results provided in g/ml (need to convert to lbs./yd^3)
- Conversion factor:

1 gm/ml = ***1,685.555*** lbs./yd^3

Example #1: 100% Coir has a bulk density of 0.064 g/ml

0.064 g/ml X 1,685.555 = 107.88 lbs./ yd^3

(dry wt. of Coir/yd^3)

Calculating Bifenthrin (Talstar/Up-Star/etc.) for Potting Media Incorporation

- Step 3. Use the table provided or the equation on the label to calculate amount of bifenthrin to add to 1 cubic yard of potting media.

- Lbs. /yd^3 of Bifenthrin = $\dfrac{\text{Bulk Density (lbs./}yd^3\text{)} \times \text{ppm*}}{2{,}000}$ (Label App. rate)

*ppm (parts per million): Use 25 ppm for "Continuous" control (see table)

Example for 100% Coir media:

- Lbs. /yd^3 of Bifenthrin = $\dfrac{(\textit{Coir})\ 107.88 \text{ lbs./}yd^3 \times 25}{2{,}000}$

= 1.35 lbs. of Bifenthrin to 1 cu yd coir media

Calculating Bifenthrin (Talstar/Up-Star/etc.) for Potting Media Incorporation

Example #2:

- Cinder/Peat (3:1) mix has a bulk density of 0.240 g/ml
- Conversion: 0.240 x 1,685.555 = 404.5332 lbs/yd^3
- Equation: $\frac{404 \text{ lbs/yd}^3 \times 25 \text{ ppm}}{2{,}000}$ = 5.05 lbs. of Bifenthrin/yd^3

Application Directions from the Up-Star label							
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	Certification	Application					
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Imported Fire	0 to 6	10	1	1.5	2	2.5	3
Ant	7 to 12	12	1.2	1.8	2.4	3	3.6
	13 to 24	15	1.5	2.25	3	3.75	4.5
	continuous	25	2.5	3.75	5	6.25	7.5

Double check calculations with table values: For cinder/peat mix with bulk density of 404, our calculation of 5.05 lb bifenthrin per cubic yard of media is consistent with table value (5 lb for bulk density of 400)

*Bulk Density = laboratory determined dry weight of a unit volume of potting media

Incorporating Talstar G (bifenthrin) into media for little fire ant and root mealybug control.

Potting plants with Talstar incorporated in media. Treatment was very effective.

Calculating Bifenthrin (Talstar/Up-Star/etc.) for Potting Media Incorporation

- Costs
  - Talstar $1.32 / lb.
  - Up-Star $1.32/lb.

  - If the Cinder/Peat calculations require 5 lbs./cu. yd.

    5 lbs. of bifenthrin X $1.32/lb.

    the cost per cu. yd. = $6.60 /cu. yd.

  -- or approximately $0.22 per 3 gal. pot
    (based on 30 pots per cu. yd)

Insecticide Trials

Slug and Snail Trials

African Snails

Semi- slugs

Cuban Slugs

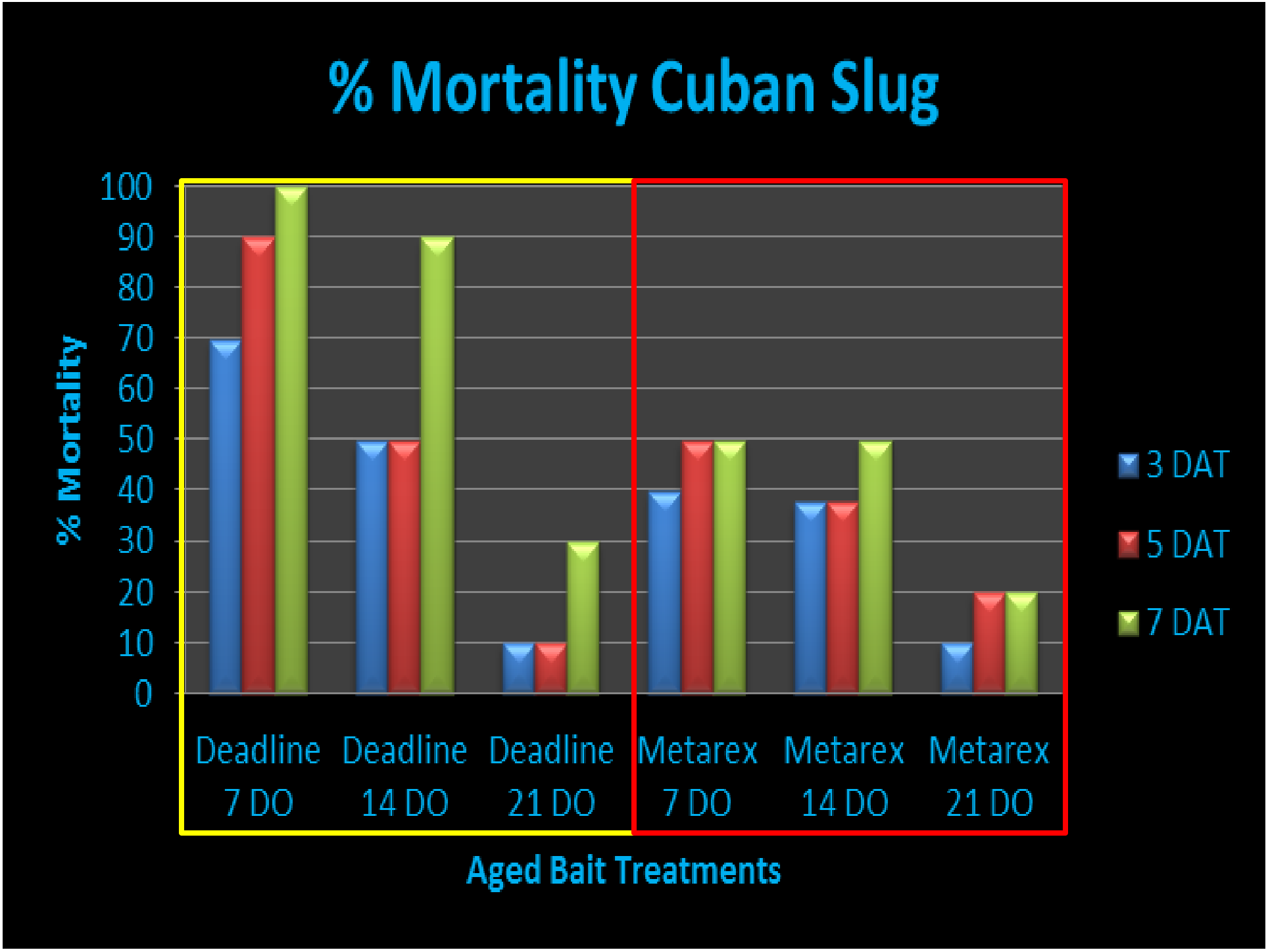
Garden Slugs

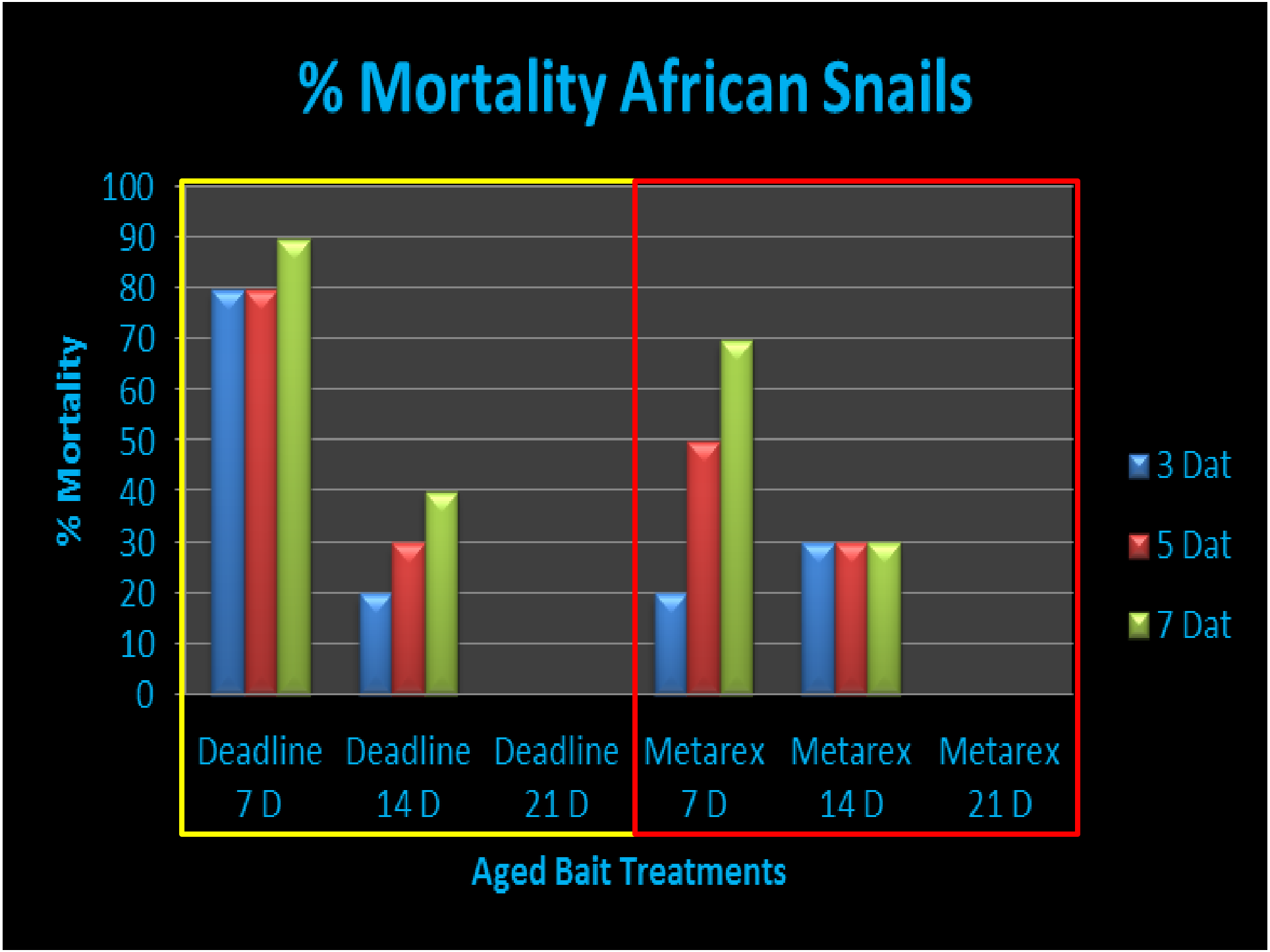
Controlling Slugs and Snails with Baits

- Metarex and Deadline were effective in controlling African snails, Cuban slugs, garden slugs, and semi-slugs as fresh deposits (both products contain 4.0% metaldehyde).
- These baits remained effective when they were weathered* 1, 4, or 7 days before being used (*exposed to rain, sun).
- Baits that were weathered longer (14 and 21 days) had moderate (<40% dead) to no effect on the slugs or snails (Deadline label for ornamentals recommends applying baits every 3-4 weeks).

Weather Data During Again Process

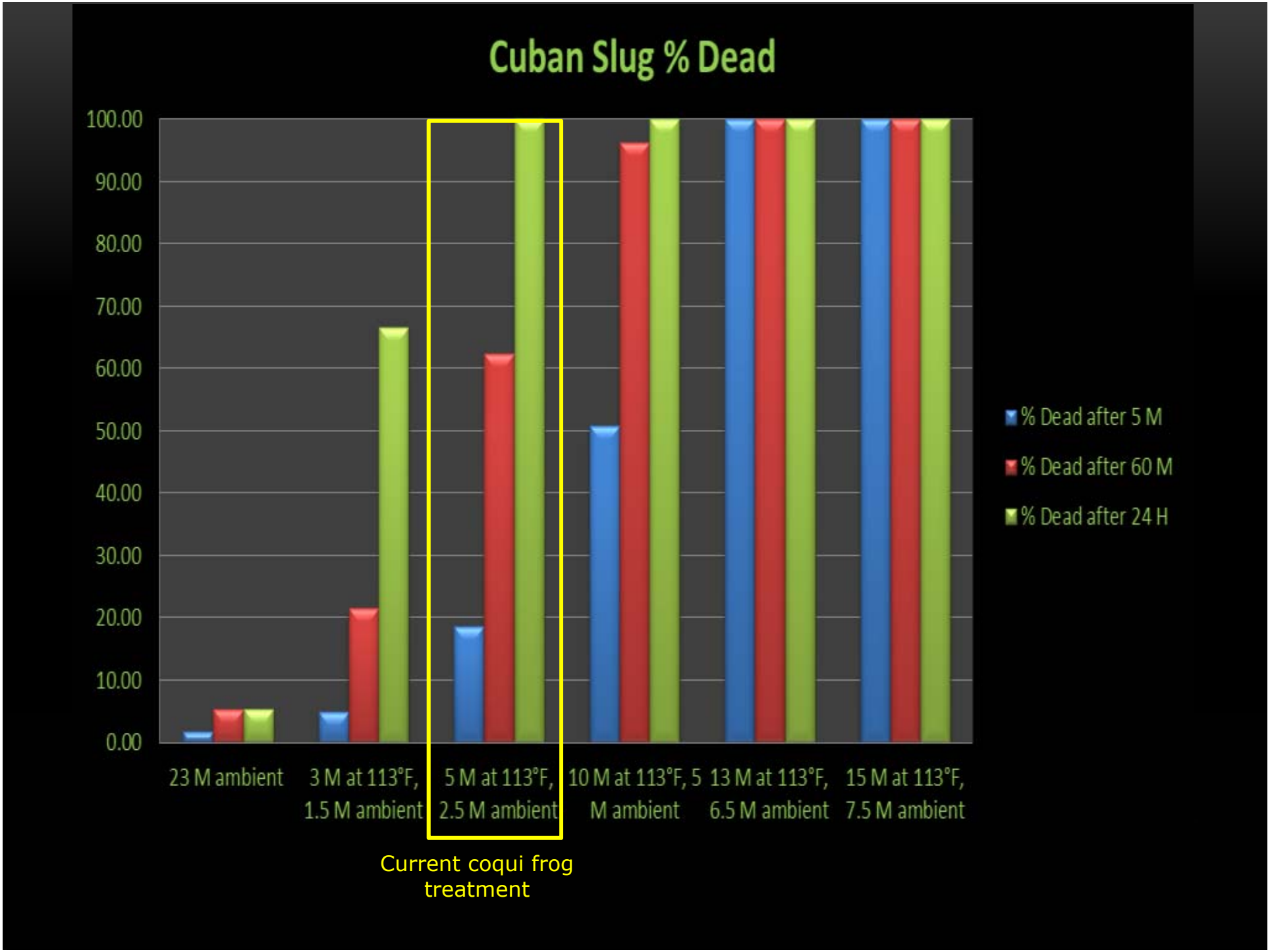
- During the "aging process" baits were exposed to natural rainfall under shade house conditions.
  - 7 Day Old (DO) baits received 3.9" of rainfall.
  - 14 DO baits received 5.2" of rainfall.
  - 21 DO baits received 13" of rainfall.
- The average temperature was 76°F with an average high of 82°F and an average low of 69°F.

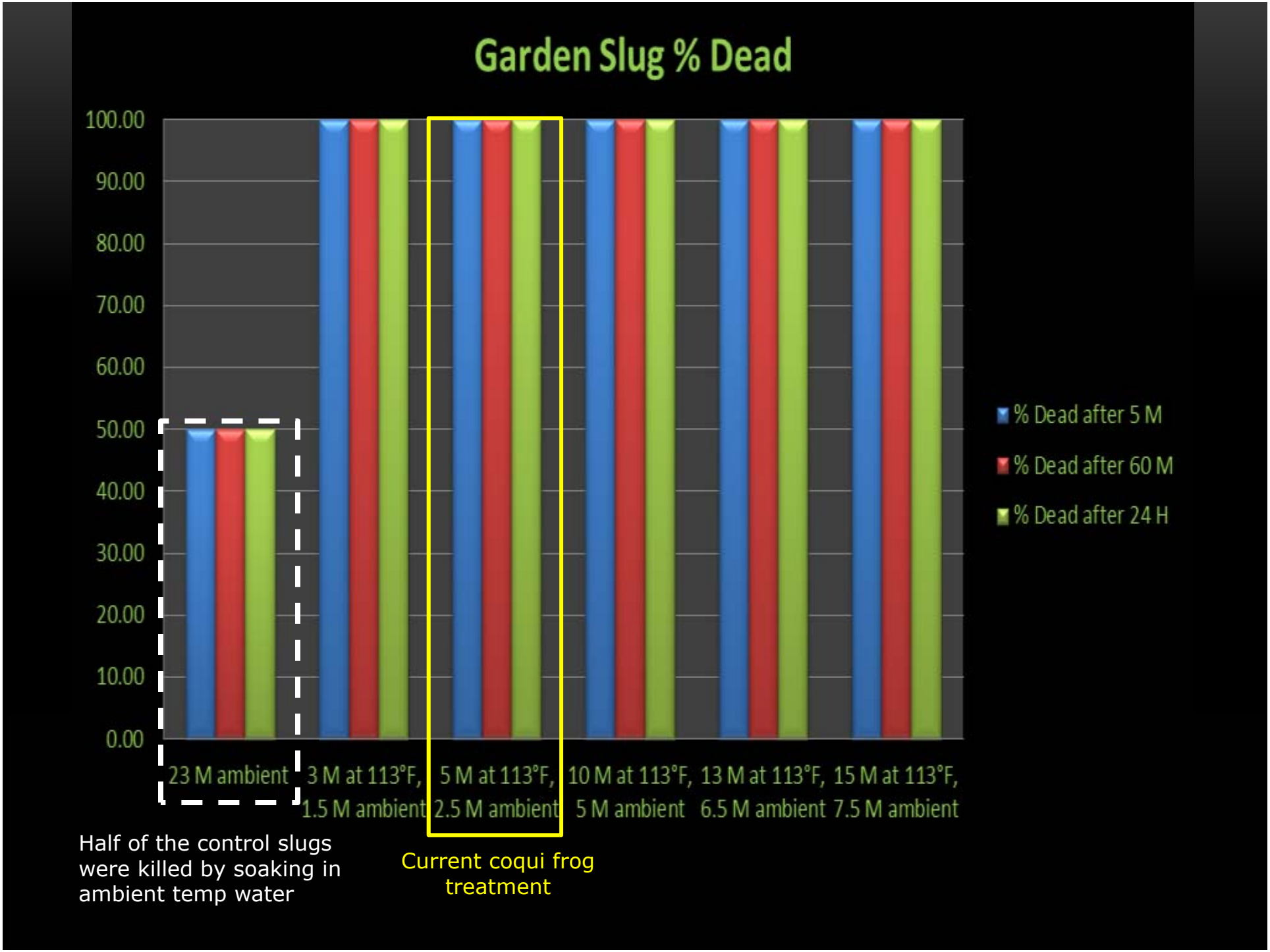

% Mortality Cuban Slug
% Mortality
100
90
80
70
60
50
40
30
20
10
0
Deadline 7 DO
Deadline 14 DO
Deadline 21 DO
Metarex 7 DO
Metarex 14 DO
Metarex 21 DO
Aged Bait Treatments
3 DAT
5 DAT
7 DAT

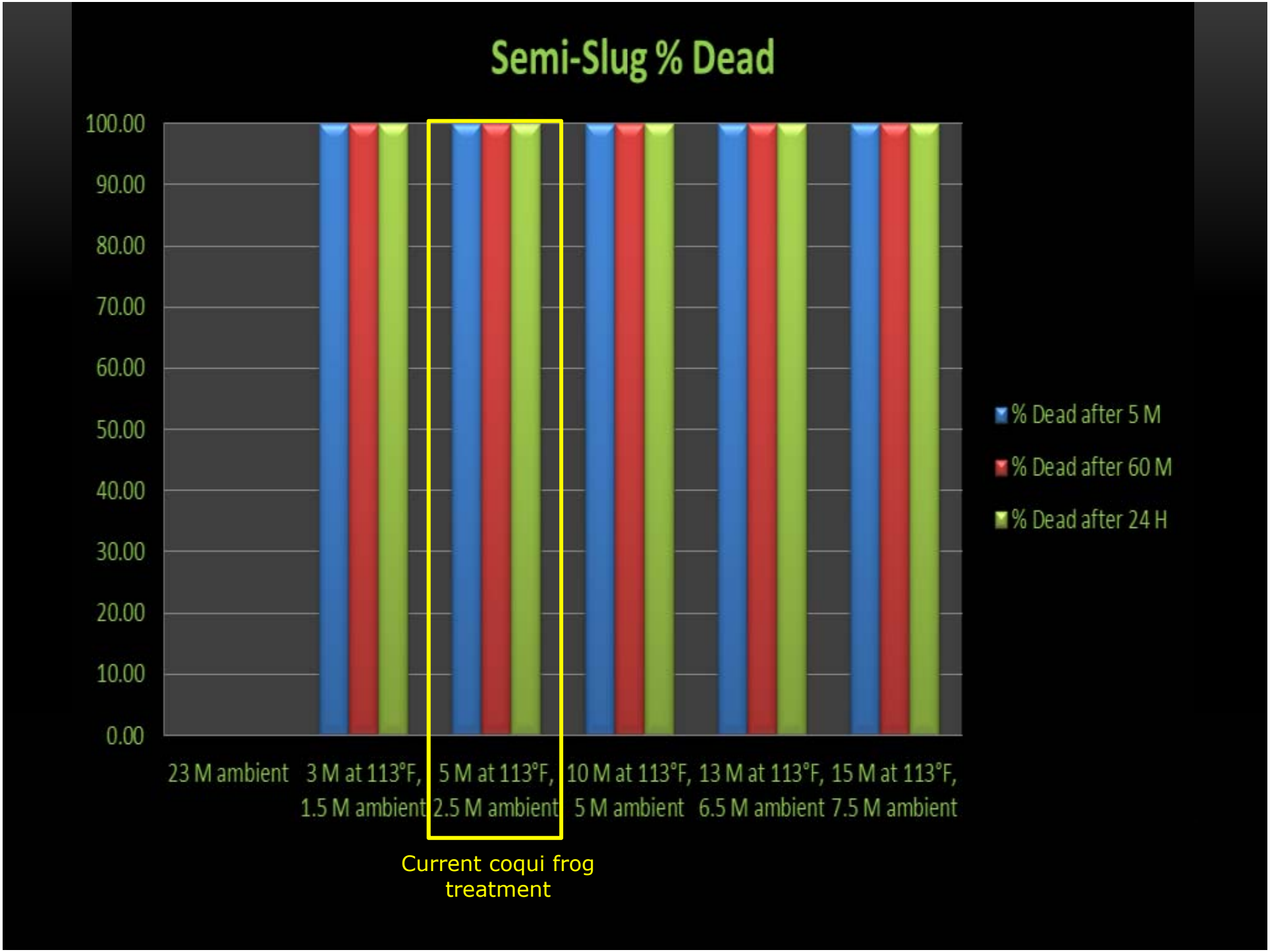

% Mortality African Snails
% Mortality
100
90
80
70
60
50
40
30
20
10
0
Deadline 7 D
Deadline 14 D
Deadline 21 D
Metarex 7 D
Metarex 14 D
Metarex 21 D
Aged Bait Treatments
3 Dat
5 Dat
7 Dat

Controlling Slugs with Hot Water

- Hot water treatments were tested to determine how effectively they would control slugs pre-shipping.
- Cuban, garden and semi-slugs were exposed to hot water treatments (113°F) for 3, 5, 10, 13, or 15 minutes with cool down in ambient temperature water (72°F) for half the hot water treatment duration (1.5, 2.5, 5, 6.5, and 7.5 minutes respectively).
- As a control, slugs were also exposed for 23 minutes to ambient temperature water (equivalent to length of the longest hot water treatment, including cool down) to make sure death was due to heat treatments and not drowning.
- Next steps include testing heat treatments within the hot shower chamber containing a full load of plants.


Cuban Slug % Dead
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
23 M ambient
3 M at 113°F, 1.5 M ambient
5 M at 113°F, 2.5 M ambient
10 M at 113°F, 5 M ambient
13 M at 113°F, 6.5 M ambient
15 M at 113°F, 7.5 M ambient
% Dead after 5 M
% Dead after 60 M
% Dead after 24 H
Current coqui frog treatment


Garden Slug % Dead
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
23 M ambient
3 M at 113°F, 1.5 M ambient
5 M at 113°F, 2.5 M ambient
10 M at 113°F, 5 M ambient
13 M at 113°F, 6.5 M ambient
15 M at 113°F, 7.5 M ambient
% Dead after 5 M
% Dead after 60 M
% Dead after 24 H
Half of the control slugs were killed by soaking in ambient temp water
Current coqui frog treatment


Semi-Slug % Dead
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
23 M ambient
3 M at 113°F, 1.5 M ambient
5 M at 113°F, 2.5 M ambient
10 M at 113°F, 5 M ambient
13 M at 113°F, 6.5 M ambient
15 M at 113°F, 7.5 M ambient
% Dead after 5 M
% Dead after 60 M
% Dead after 24 H
Current coqui frog treatment

Controlling Little Fire Ants

Active Ingredients:

1.00% Hydramethylnon, similar AI to Amdro & Probait

Mode of Action: Disrupts energy metabolism.

Maxforce Complete granules contain a bait matrix combining sugars, proteins (including silk worm pupae), fats and oils, which accommodate insects' changing nutritional needs**.**

Ants (Acrobat, Argentine, Big Headed, Carpenter, Cornfield, Field, imported and native Fire, Ghost, Harvester, Odorous House, Pavement, Pharaoh, Thief)

Maxforce® Complete Brand Granular Insect Bait is a ready-to-use product for use indoors and outdoors and around buildings, on lawn, and other non-crop areas: (including school yards, playgrounds, golf courses, and ornamental nurseries).

Active Ingredient:
Hydramethylnon 0.36%
Methoprene 0.25%

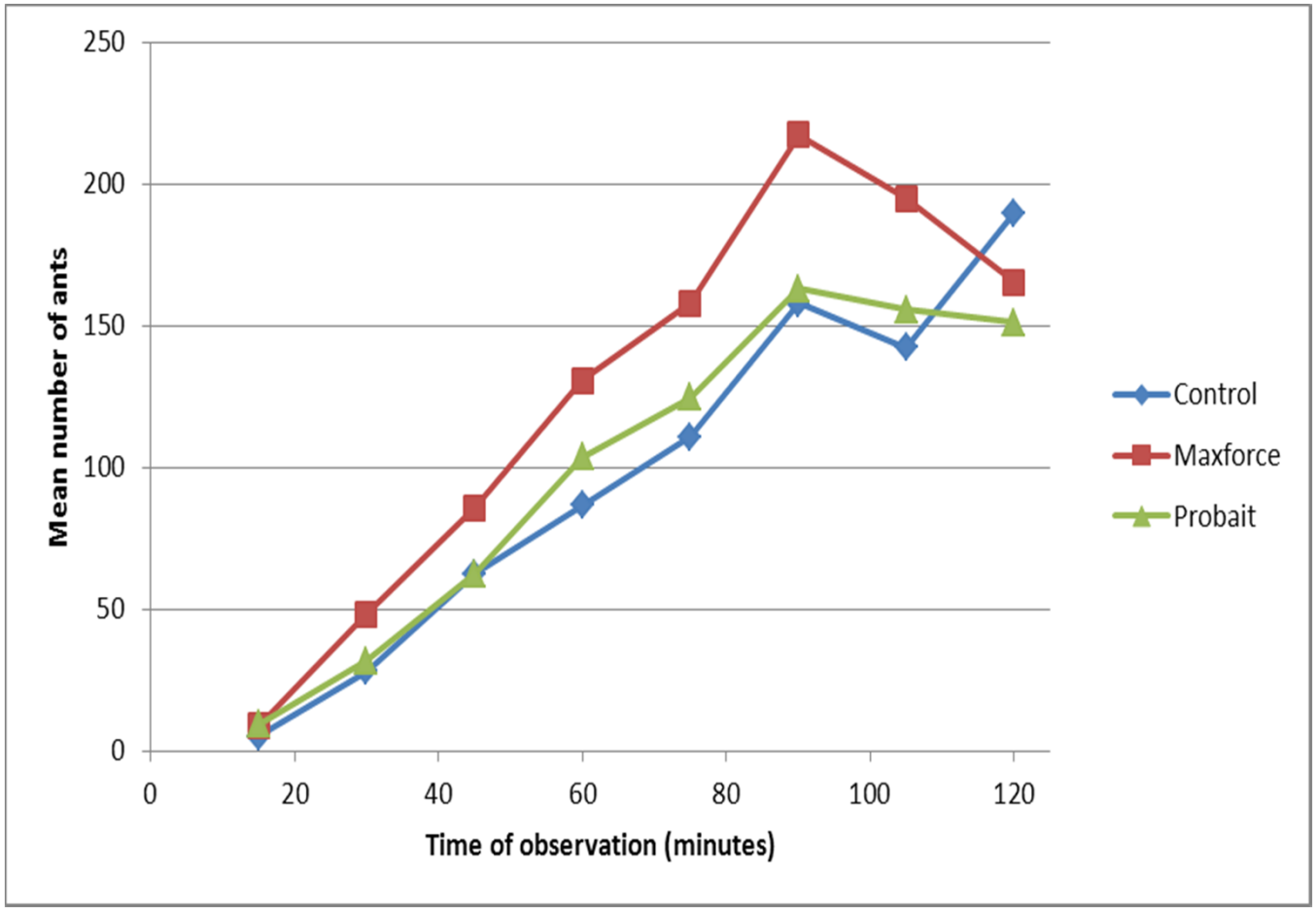
Wellmark Extinguish PLUS IGR

Active Ingredient:
0.73% Hydramethylnon

Bait Attraction in a Plot with Little Fire Ants
(no other species present)

1 Hour after placement			
	Control (Peanut Butter)	MaxForce Complete 1.00% hydramethylnon	Probait 0.73% hydramethylnon
2 Hours after placement			

Number of little fire ants attracted to hydramethylnon baits over time



More LFA tended to be attracted to Maxforce formulation than Probait or peanut butter for most of the 2 hours of observation.

Attractiveness of peanut butter, Probait, Extinguish Plus & Extinguish Professional to LFA

Peanut butter

Probait
0.73% hydramethylnon

Extinguish Plus 0.36%
hydramethylnon + 0.25% S-methoprene

Extinguish Professional
0.50 % S-methoprene

Least attractive to LFA possibly due to 2x methoprene than Extinguish Plus

LITTLE FIRE ANT CONTROL

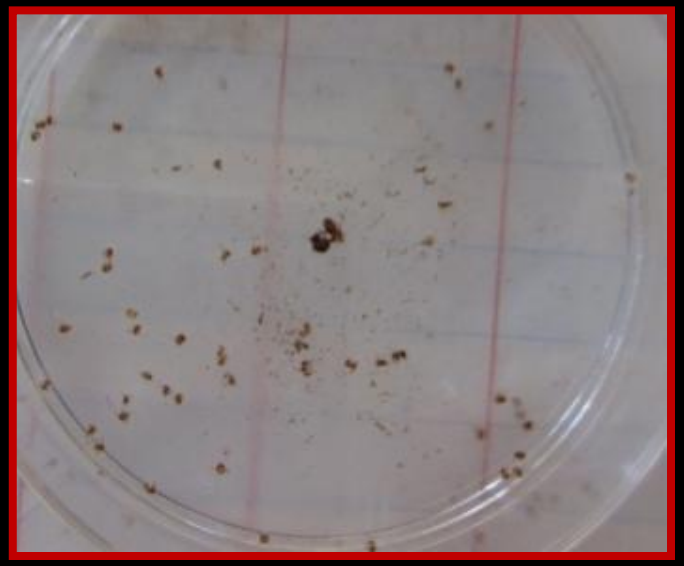
* Maxforce Compete, Probait/Amdro (hydramethylnon) & Extinguish Plus (hydramethylnon + methoprene, insect growth regulator) are most effective.
* Esteem (pyriproxyfen, IGR) is labeled for tropical fruit crops.
* Arboreal colonies in trees are difficult to control (bait must be in trees)
* Tango (methoprene) mixed with vegetable oil and xanthan gum (emulsifier and thickener) can be applied in trees (Vanderwoude).
* Talstar granular and liquid effective as a residual contact/barrier treatment.
* Termidor (fipronil, PCO only, for building perimeter) is effective.

Untreated

Nest Activity
7 WAT

Extinguish Plus

(0.365% hydramethylnon & 0.25% S-methoprene



Tango bait formulation for arboreal LFA colonies

3 cups warm water

2 cups corn oil or other vegetable oil

4 Tbsp Tango (methoprene)

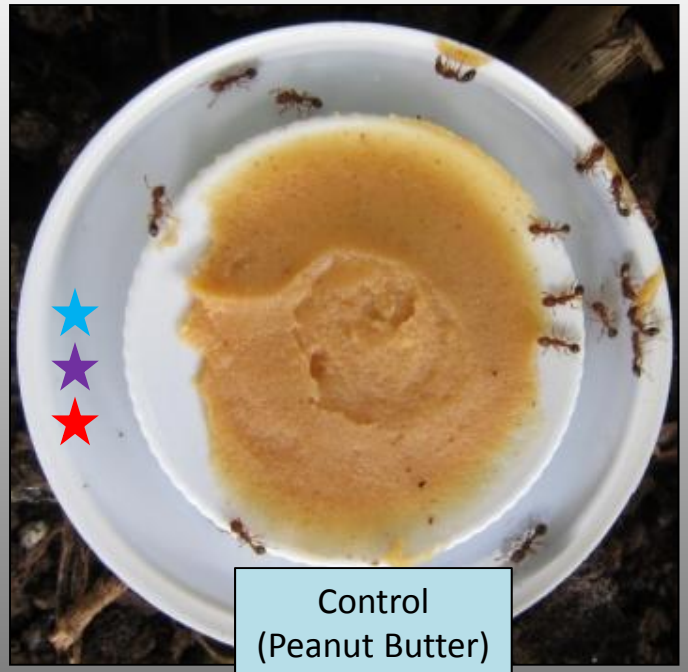
1 Tbsp xanthan gum

Formulation will have the consistency of mayonnaise. Apply with hand-held sprayer up into trees.

Cas Vanderwoude www.littlefireants.com

Bait Attraction in a Plot without Little Fire Ants (other species present)

1 Hour after placement

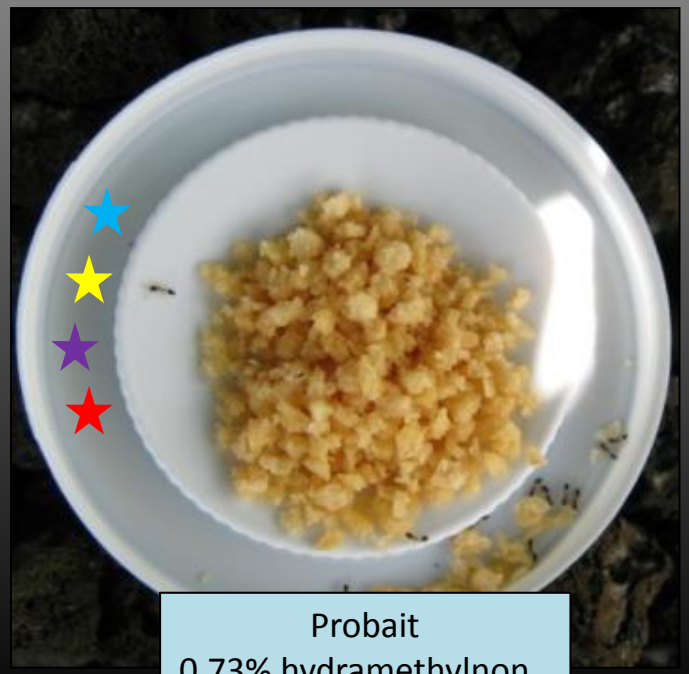


Control
(Peanut Butter)

Ants attracted to baits:

- ★ *Monomorium floricola* floral ant
- ★ *Plagiolepis alluaudi* little yellow ant
- ★ *Pheidole moerens*
- ★ *Tetramorium bicarinatum*

Maxforce Complete
1.00% hydramethylnon



Probait
0.73% hydramethylnon

Control
(Peanut Butter)

1 Hour after placement

Ants attracted to baits:

- *Anoplolepis gracilipes*
  long legged ant
- *Monomorium floricola*
  floral ant
- *Plagiolepis alluaudi*
  little yellow ant
- *Pheidole moerens*
- *Tapinoma melanocephalum*
  ghost ant
- *Tetramorium simillimum*

Probait
0.73% hydramethylnon

Advion
0.05% indoxacarb

Pheidole moerens was attracted to all baits

Peanut butter did not attract the little yellow ant or *Tetramorium simillimum*

Optigard
0.01% thiamethoxam

Systems Approach to Pest Control: Using Hot Water

The Original Portable Hot Shower Chamber

Modification: Stationary, Drive-Through Hot Shower Design

Adaptation: Small scale hot water “sprench” to dislodge coqui frogs and eggs from potted plants

Ecotemp L10 tankless water heater

Modification: Nozzles in hot shower chamber directed with hoses to drench pots and media

Generating Steam to Sterilize Cinder Media

Large-scale (truck load)

(Media cart load)

Coming soon…

…the new hot water shower chamber

Mahalo!

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2008 Farm Bill - Section 10201
Arnold H Hara