RESEARCH FOR HAWAII'S POTTED FOLIAGE INDUSTRY (2012-2013)

This newsletter summarizes the results of trials conducted to determine best management practices to prevent, eliminate, or reduce pests at Critical Control Points from field to market for export foliage plant production in Hawaii.

Jorden A. Zarders, Arnold H. Hara, Susan K. Cabral, and Ruth Y. Niino-DuPonte
University of Hawaii at Manoa, College of Tropical Agriculture & Human Resources
875 Komohana St. Hilo, Hawaii 96720

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Precautionary statement
Consult a chemical sales representative, the Hawaii Department of Agriculture, or the University of Hawaii Cooperative Extension Service for correct formulation of pesticides, more information, or updated recommendations. The user is responsible by law to read and follow all current label directions for proper use, application, storage, and disposal of pesticides. The label is the law! To avoid injury to your crop by a pesticide, always conduct a small scale test before making large scale application. Tests should be conducted at the label rate and sprayed at least twice according to interval specified on the label. Allow 5 to 7 days for symptoms to appear. For systemic insecticides, allow 14 to 21 days for symptoms to appear.

Disclaimer
This publication contains results of pesticide trials that are subject to change at any time. These results are provided only as a guide. Due to constantly changing labels and product registration, some of the products evaluated may no longer be legal by the time you read this. If any information in this publication disagrees with the label, the results MUST be disregarded. Brand names are used for product name recognition and their use is not intended to discriminate against similar products not mentioned or evaluated, or to be a recommendation of only those products mentioned. The authors, College of Tropical Agriculture and Human Resources, University of Hawaii, Hawaii Department of Agriculture, and the United States Department of Agriculture assume no liability resulting from the use of these results.

RESEARCH FOR HAWAII'S POTTED FOLIAGE INDUSTRY (2012-2013)

INTRODUCTION

Our goal for this Federal Farm Bill project is to help nurseries exporting ornamental potted plants from Hawaii to examine their current practices in the context of implementing a systems approach to pest management from field to market. By analyzing and identifying pest entry points at all plant production sites, steps can be implemented to prevent, eliminate or reduce each pest at Critical Control Points (CCP) within their nursery operation. Trials were conducted to address each nursery's areas of concern, and the results summarized here provided cooperators with Best Management Practices (BMP) to ensure that plant production is free of quarantine pests.

FARM BILL

Systems Approach to Pest Management Practices-Potted Foliage Plant Production - Phase II

A systems approach to producing pest-free potted plants will be implemented at potted foliage plant nurseries in Hawaii. The systems approach combines field pest management practices and an inspection/ postharvest treatment into a unified system to produce pest-free products. The systems approach is based on the fact that field control measures, such as chemical control, can reduce pest populations to a level at which a postharvest treatment (e.g., hot water dip or shower) is 100% effective against quarantine pests.

Acknowledgements

We gratefully recognize U.S. Department of Agriculture, Hawaii Department of Agriculture, and the ornamental plant industry for their support and cooperation, and Kris L. Aoki, Jon Katada, and Jade Miyashiro for their contributions to these research accomplishments.

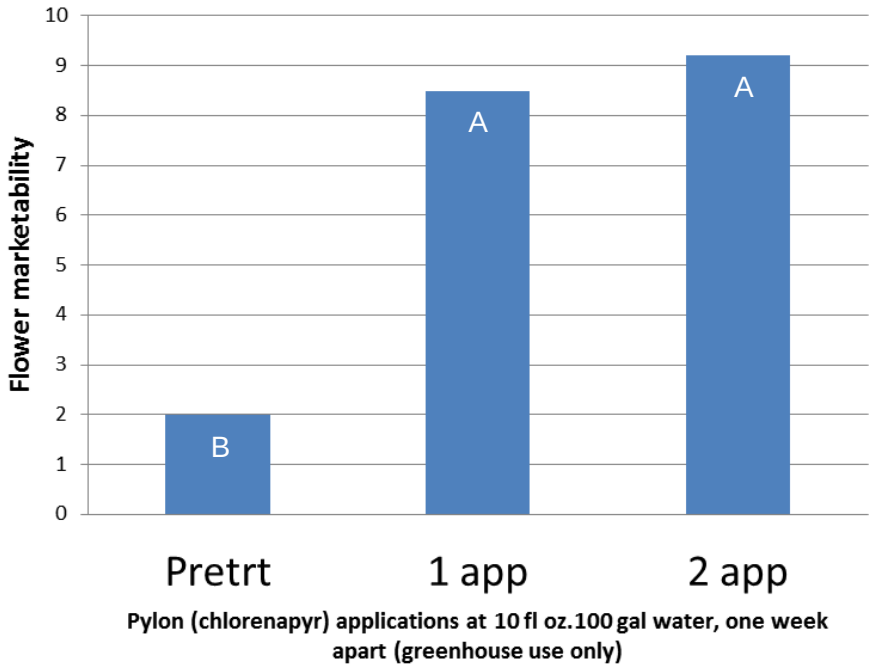
ANTHURIUM

Pylon (chlorfenapyr) to Control Melon Thrips, *Thrips palmi*

The efficacy of Pylon (chlorfenapyr) against damage caused by melon thrips, *Thrips palmi*, was evaluated on anthurium 'Lavender Lady' (pictured, right).

- One foliar application of Pylon at the highest label rate (10 fl oz/100 gal water) significantly increased anthurium flower marketability based on thrips damage (Fig. 1).
- After a second application one week later, thrips damage was reduced further and remained suppressed for six weeks after treatment.
- **Pylon proved to be highly effective on melon thrips**, which are not controlled by insecticides used against anthurium thrips, *Chaetanaphothrips* spp.
- *Pylon, however, is registered for use in completely enclosed greenhouses.*

Figure 1. Effect of chlorfenapyr (Pylon) on anthurium damage by melon thrips, *Thrips palmi*



AB Means denoted by bars with the same letter were not different (P>0.05, Tukey's test)
No phytotoxicity was observed during the duration of this trial.

Anthurium flower rating scale (1-10), where '1' = flowers not fully open due to severe deformity and scarring, and '10' = no visible damage on front and back of flower. A rating below '7' indicated a flower was not marketable due to thrips damage.

ANTHURIUM

Granular Insecticides and Mycotrol O to Control Anthurium Thrips, Banana Rust Thrips, and Anthurium Whitefly

Granular insecticides applied as top dressing, Safari 2G (dinotefuran; 2.30 g per pot), Marathon 1%G (imidacloprid; 2.0 g per pot), Precise (acephate; 7.0 g per pot), and foliar sprayed Mycotrol O (*Beauveria bassiana;* 35 ml per gal) were evaluated on containerized anthurium 'Marian Seefurth' against damage caused by banana rust thrips, *Chaetanaphothips signipennis,* and anthurium thrips, *Chaetanaphothrips orchidii*.

- **Safari 2G and Marathon 1%G were very effective** in decreasing thrips-damage to flowers for 10 weeks after treatment (Fig. 2).
- As the only foliar-applied treatment, Mycotrol O did not reduce thrips-damage when compared with the untreated control, possibly due to limited contact with thrips that are protected by residing within unfurled anthurium leaves and flowers.

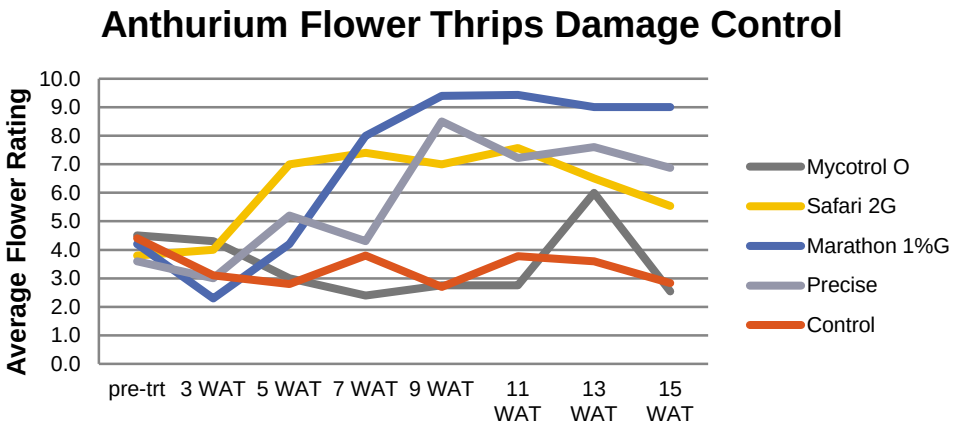
RATING OF THRIPS DAMAGE ON 'MARIAN SEEFURTH' ANTHURIUMS

Anthurium flower rating scale (1-10), where '1' = flowers not fully open due to severe deformity and scarring, and '10' = no visible damage on front and back of flower. A rating below '7' indicated a flower was not marketable due to thrips damage.

These insecticides were also tested against anthurium whitefly, *Aleurotulus anthuricola,* on anthuriums grown in cinder beds (1,000 sq ft). Safari 2G (0.155 lb/bed), Marathon 1%G (3.75 oz/bed), and Precise (576 g/bed) were applied as top dressing, and Mycotrol O (16 oz/ 25 gal water) was applied as a foliar spray on anthurium 'Pele'.

- **Safari 2G and Marathon 1%G were the most effective**, with little to no anthurium whiteflies observed at six weeks after treatment (Fig. 3).
- Again, Mycotrol O did not reduce thrips-damage when compared with the untreated control.

Figure 2. Granular insecticides and Mycotrol O against damaged caused by anthurium thrips and banana rust thrips on anthurium 'Marian Seefurth' flowers.

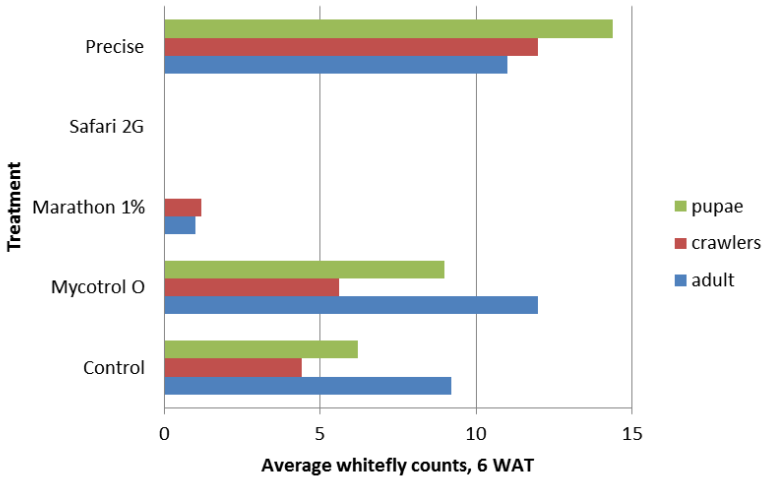


*Application rates: Safari 2G (dinotefuran) at 2.30 g per pot, Marathon 1%G (imidacloprid) at 2.0 g per pot, Precise (acephate) at 7.0 g per pot; foliar sprayed Mycotrol O (*Beauveria bassiana*) at 35 ml per gal water. No phytotoxicity was observed during the duration of this trial.

No whiteflies on stems of plants treated with Safari 2G

Anthurium whiteflies on stems of untreated control

Figure 3: Granular insecticides and Mycotrol O against anthurium whitefly on anthurium 'Pele' in cinder beds, 6 weeks after treatment (WAT).



*Application rates: Safari 2G (dinotefuran) at 0.155 lb/ bed, Marathon 1%G (imidacloprid) at 3.75 oz/bed, Precise (acephate) at 576 g/ bed and foliar sprayed Mycotrol O (*Beauveria bassiana*) at 16 oz/ 25 gal water. No phytotoxicity was observed during the duration of this trial.

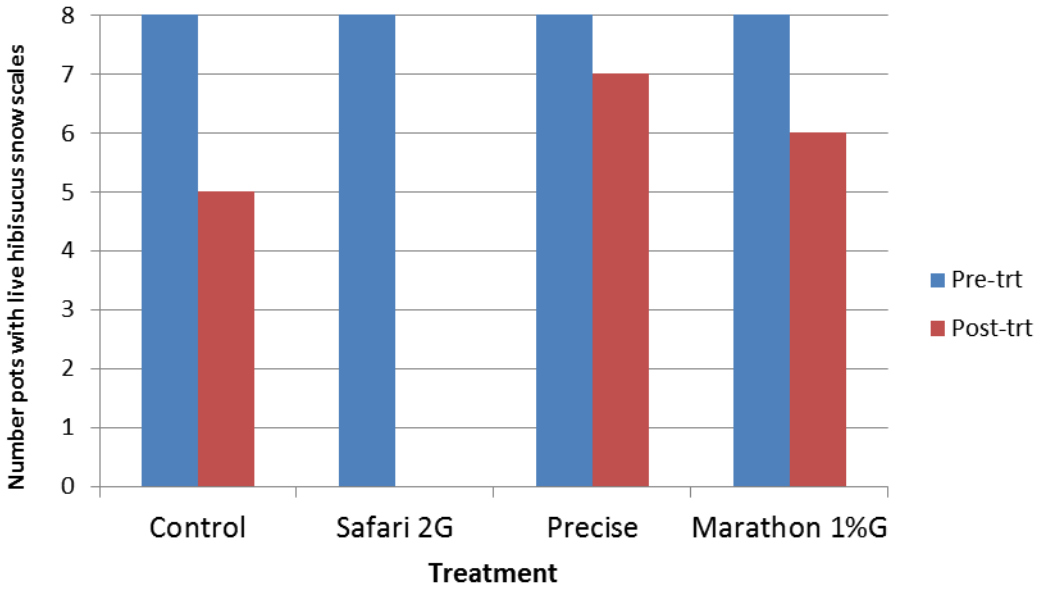
DRACAENA

Granular Insecticides to Control Hibiscus Snow Scale

Three granular insecticides were evaluated as top dressing for control of hibiscus snow scale, *Pinnaspis strachani* (circled, left), infesting dracaena 'Warneckii' grown in two gallon pots with four canes per pot.

- Ten weeks after treatment**, Safari 2G (dinotefuran; 1 tsp/pot) was the most effective** against hibiscus snow scale when compared to Precise (acephate; 3 tsp/pot) and Marathon 1%G (imidacloprid; 5 tsp/pot) and untreated control (Fig. 4).
- Safari 2G (granules) have been discontinued by Valent; however liquid Safari 20 SG is available.

Figure 4: Granular insecticides to control hibiscus snow scale on potted Dracaena 'Warneckii' 10 weeks after treatment



*Rates: Safari 2G (dinotefuran) at 1 tsp/pot, Precise (acephate) at 3 tsp/pot, and Marathon 1%G (imidacloprid) at 5 tsp/pot. No phytotoxicity was observed during the duration of this trial.

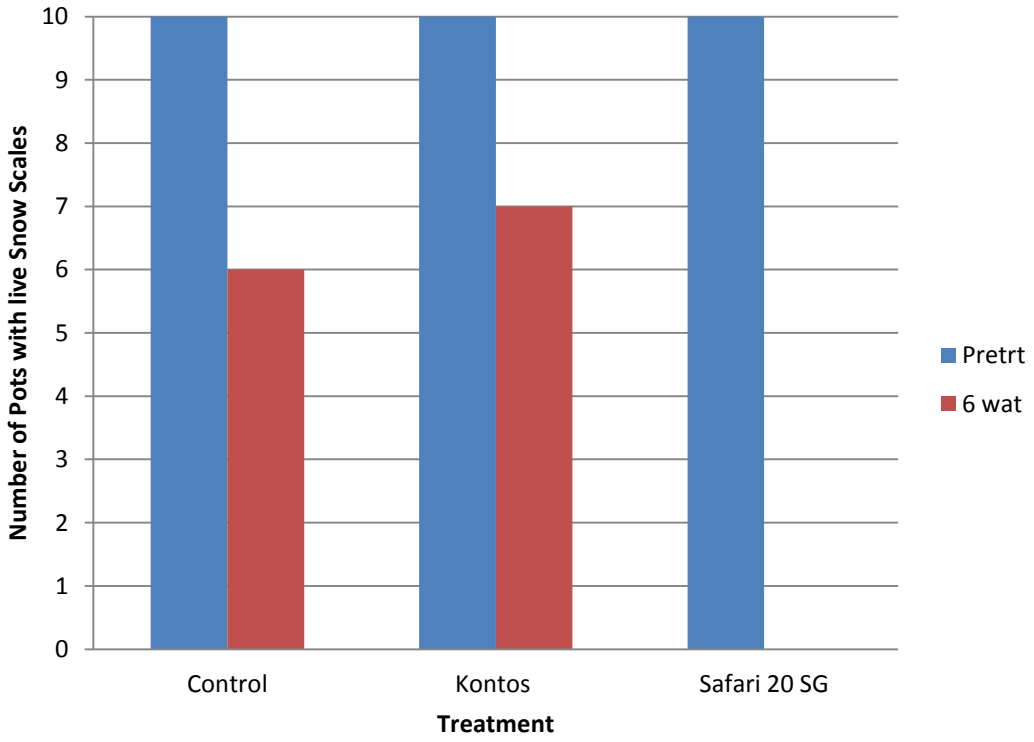
DRACAENA

Insecticidal Dips to Control Hibiscus Snow Scale on Tip Cuttings of Dracaena 'Janet Craig Compacta'

Insecticidal dips were assessed as a pre-planting treatment of dracaena tip cuttings to control hibiscus snow scale. 'Janet Craig' tip cuttings were dipped in Safari 20SG (dinotefuran; 1 tsp/gal water) or Kontos (spirotetramet; 3.4 fl oz/100 gal water) prior to being planted (four canes per pot, 10 pots per treatment).

- **At 6 weeks after treatment, no live scales were found on canes dipped in Safari 20SG**, while 70% of pots treated with Kontos had live scales on at least one cane, as compared to 60% of untreated pots (Fig. 5).
- In previous trials, effects of Kontos on homopteran insects (sucking insects including scales, mealybugs, aphids, whiteflies, etc.) were not observed until after 6 weeks.
- Scales displayed evidence of being parasitized by biological control agents in 27% of canes in the control group, 47% in the Kontos treatment, and 50% in the Safari treatment.

Figure 5: Insecticidal Dips against Hibiscus Snow Scale on Tip Cuttings of Dracaena 'Janet Craig Compacta', 6 weeks after treatment (WAT).



*Rates: Safari 20SG (dinotefuran) at 1 tsp/gal water, and Kontos (spirotetramet) at 3.4 fl oz/100 gal.
No phytotoxicity was observed during the duration of this trial.

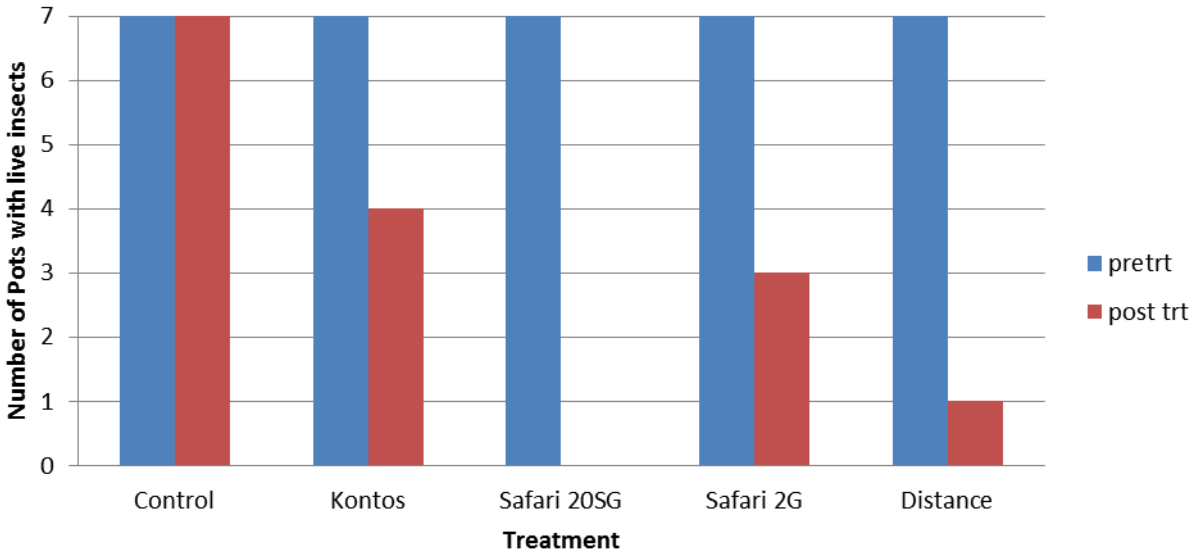
DRACAENA

Top Dress Granular or Foliar Applications to Control Hibiscus Snow Scale on Potted Dracaena 'Janet Craig Compacta'

A top dress granular insecticide, Safari 2G (dinotefuran; 1 tsp /pot), and foliar applications of Kontos (spirotetramat; 3 ml/ 3 gal water), Safari 20 SG (dinotefuran; 1.0 tsp/ gal water), and Distance (pyriproxyfen; 12 oz./ gal water) plus Liberate (lecithin; 1.5 fl oz/5 gal water) as a surfactant were evaluated for control of hibiscus snow scale on potted dracaena 'Janet Craig Compacta' planted six weeks earlier (3-,2- and 1-ft tip cuttings per pot, 7 pots per treatment).

- At 6 weeks after treatment (WAT), there were no live scales among pots treated with Safari 20 SG (foliar), while 43% of pots treated with Safari 2G (top dressing) had live scales (Fig. 6).
- Among Distance- and Kontos-treated pots, 14% and 57%, respectively, had at least one viable snow scale.
- While all insecticides evaluated reduced snow scale populations when compared to the controls, dracaena plants treated with Safari 20 SG and Distance had fewer scales 6 WAT.

Figure 6: Top Dress or Foliar Applications of Insecticides to Control Hibiscus Snow Scale on Potted Dracaena 'Janet Craig Compacta' (6 weeks after treatment).



*Rates: top dressed Safari 2G (dinotefuran) 1 tsp per/ pot and foliar applications of Kontos (spirotetramat) at 3 ml/ 3 gal water, Safari 20 SG (dinotefuran) at 1.0 tsp/ gal water, Distance (pyriproxyfen) 12 oz./ gal water with Liberate (lecithin) at 1.5 fl oz/5 gal as a surfactant. No phytotoxicity was observed during the duration of this trial.

Physical Barrier in Reducing Ambrosia Beetle Attacks on Containerized Dracaena

A non-chemical preventative technique, insect barrier screen, was compared to a commonly used carbaryl insecticide to reduce ambrosia beetle (*Xyleborus* spp.) attacks on containerized character dracaena 'Marginata'.

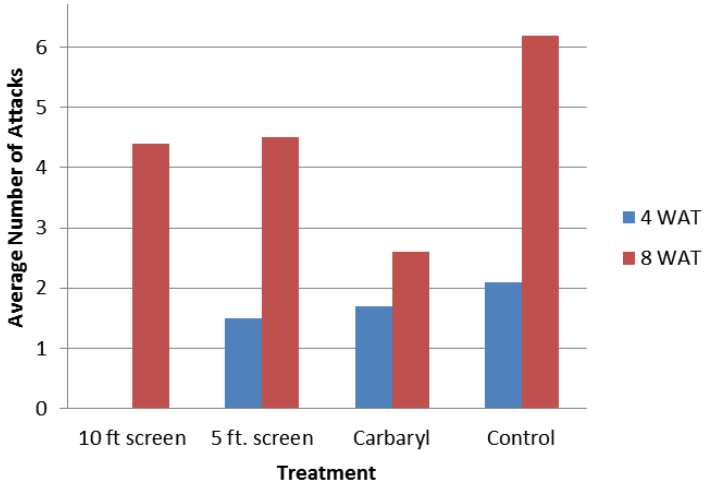
Rebar poles were anchored into the ground as stabilizing guides for ¾" PVC pipes to form a frame for erecting a 4-sided (no top) barrier of insect screen (high density polyethylene, 30x26 mesh per square

inch) attached with PVC c-clamps around the perimeter of grow benches (10 ft L x 5 ft W).

Each bench held six containerized dracaena stumps planted just prior to treatment. Treatments were 10 ft barrier, 5-ft barrier, and no barrier with trunk spraying (carbaryl; 5 fl oz/gal water) (pictured below).

- For 5 weeks, there were no ambrosia beetle attacks on the grow bench within the 10 ft. screen barrier (Fig. 7).
- Strong winds occurring 7 to 8 weeks after treatment may have transferred ambrosia beetles from adjacent macadamia nut groves over the top of the 10 ft barrier.
- Plants sprayed with carbaryl had the least number of ambrosia beetle attacks at 8 weeks after treatment.
- Total enclosure with insect screen or a combination of screen barrier and carbaryl trunk treatments may provide increased protection and control of ambrosia beetle attacks on containerized dracaena.
- Insect screen barriers show potential in reducing ambrosia beetle infestations, but more trials are needed to confirm their effectiveness in dracaena production.

Figure 7: Comparison of Physical Barriers and Carbaryl Application in Reducing Ambrosia Beetle Attacks on Containerized Dracaena



*Rate: carbaryl at 5 fl oz/gal water.

DRACAENA

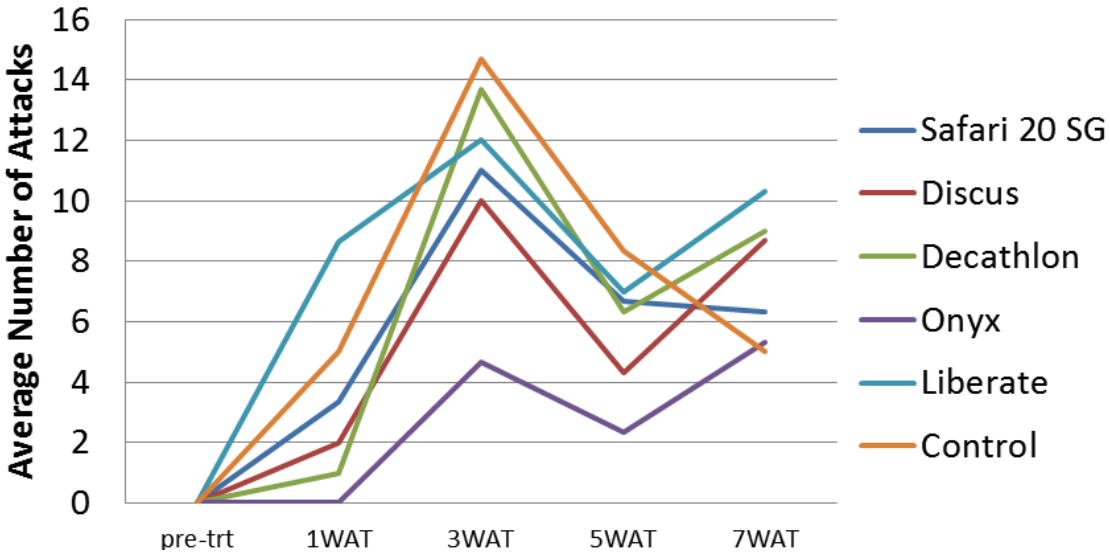
Preventative Contact Insecticidal Trunk Sprays To Reduce Ambrosia Beetle Attacks on Dracaena Cuttings

Safari 20SG (dinotefuran; 1 tsp/gal water), Discus (cyfluthrin/imidacloprid; 14.78ml/gal water) with Liberate (lecithin; 8.88ml/gal water), Decathlon 20SC (cyfluthrin; 54g/gal water) with Liberate (8.88ml/gal), and Onyx (bifenthrin; 4.68ml/gal) with Liberate (8.88ml/gal) were evaluated as trunk spray treatments of dracaena 'Massangeana' and 'Tri-color' cuttings against ambrosia beetle attacks.

Using the tree injector system, Arborjet, dracaena canes (3 ft. long, 3" diameter) were injected with 20 ml of 70% ethanol to simulate plant stress and induce ambrosia beetle attacks. Entire canes were sprayed prior to planting and again after three weeks.

- All chemical treatments reduced ambrosia beetle attacks as compared with untreated canes (Fig. 8).
- More replication is needed to determine whether Insecticidal trunk treatments can adequately reduce ambrosia beetle attacks on dracaena cuttings.

Figure 8: Insecticidal Trunk Sprays to Prevent Ambrosia Beetle Attacks on Dracaena Cuttings



*Rates: Safari 20SG (dinotefuran) at 1tsp/gal, Discus (cyfluthrin/imidacloprid) at 14.78ml/gal with Liberate at 8.88ml/gal, Decathlon 20SC (cyfluthrin) at .54g/gal with Liberate at 8.88ml/gal, Onyx (bifrenthrin) at 4.68ml/gal and Liberate (lecithin) at 8.88ml/gal. No phytotoxicity was observed during the duration of this trial.

PALMS

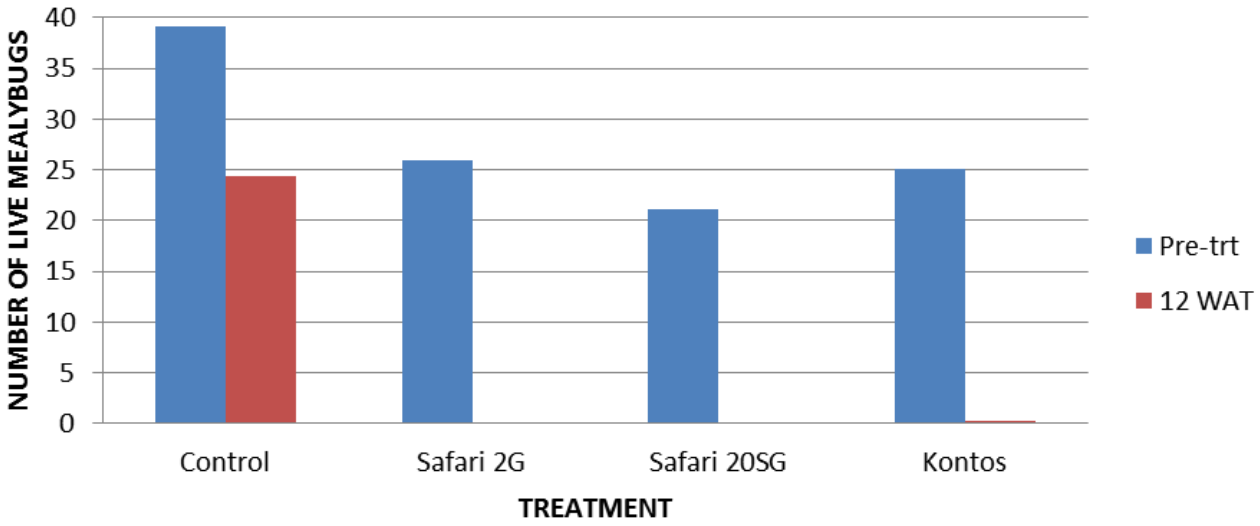
Granular and Drench Insecticides against Palm Mealybug on Rhapis Palm

The ability of systemic insecticides to be translocated in taller plants with multiple growing points and their persistence to control palm mealybugs, *Palmicultor palmarum* (pictured, right), were evaluated. Safari 2G (dinotefuran; top-dress at 18.2 g/pot), Safari 20 SG (drench at 1.54 g/pot), and Kontos (spirotetramat; drench at 1.3 ml/pot) were applied to 6+ ft tall potted rhapis palms (9 pots per treatment).

*Palm mealybug infestation; close up of female (circled).

- **Safari 2G and Safari 20 SG effectively kept the palms free of live palm mealybugs from 6 to 12 weeks after treatment** (Fig. 9).
- Kontos (spirotetramet) also achieved good control of the target pest; however, 22% of treated trees had a single live mealybug at weeks 8 and 12.

Figure 9: Granular and Drench Insecticides to Control Palm Mealybug on Rhapis Palm



*Rates: Safari 2G (top-dress) at 18.2 g/pot, Safari 20 SG (drench) at 1.54 g/pot and Kontos (drench) at 1.3 ml/pot.
No phytotoxicity was observed during the duration of this trial.

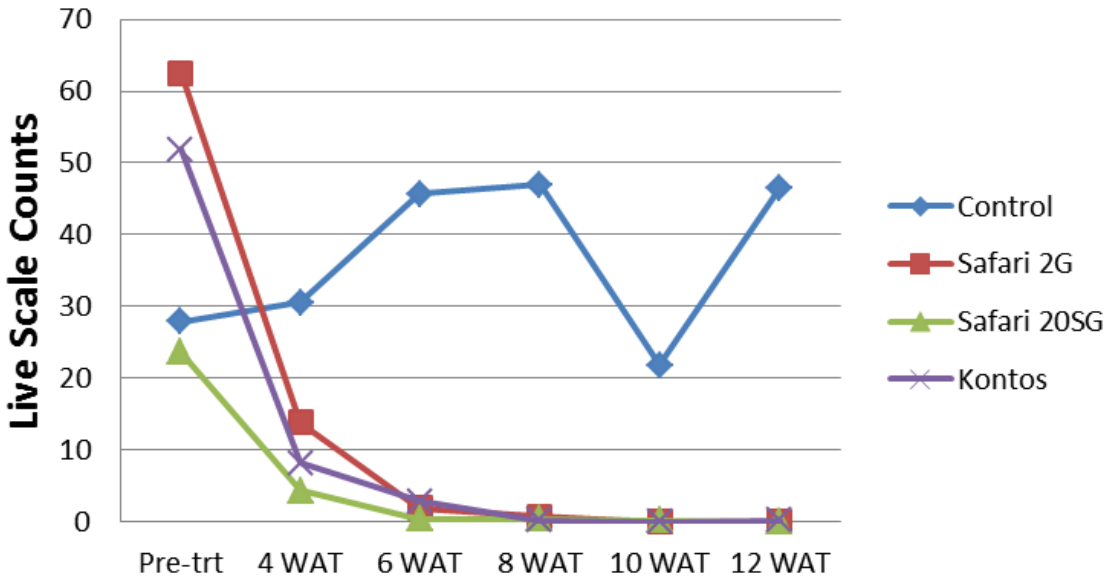
PALMS

Efficacy of Granular and Drench Insecticides for Coconut scale on Kentia Palms

The efficacy and persistence of drench and granular systemic insecticides were evaluated on containerized 2 gal kentia palms to control coconut scale, *Aspidiotus destructor* (pictured, right). Safari 2G (top-dress, 7.8 g/ pot), Safari 20 SG (drench, 7.8/pot) and Kontos (drench, 3.64 ml/pot) were applied once. Live adult scales were indicated by their yellowish-orange color.

- By 4 weeks after treatment, Kontos and Safari as a drench or granular top-dress were equally effective ($P<0.05$) in lowering scale counts as compared to the control (Fig. 10), and their effectiveness persisted for 12 weeks after treatment.
- **Based on chemical class, Safari and Kontos can be used in rotation for control of coconut scale.**

Figure 10: Drench and Granular Insecticides to Control Coconut Scales on Potted Kentia Palms



*Rates: Safari 2G (top-dress) at 7.8 g/ pot, Safari 20 SG (drench) at 7.8 g/pot and Kontos (drench) at 3.64 ml/pot. No phytotoxicity was observed during the duration of this trial.

COQUI FROGS

In Vitro Efficacy of Pyronyl against Coqui Frogs

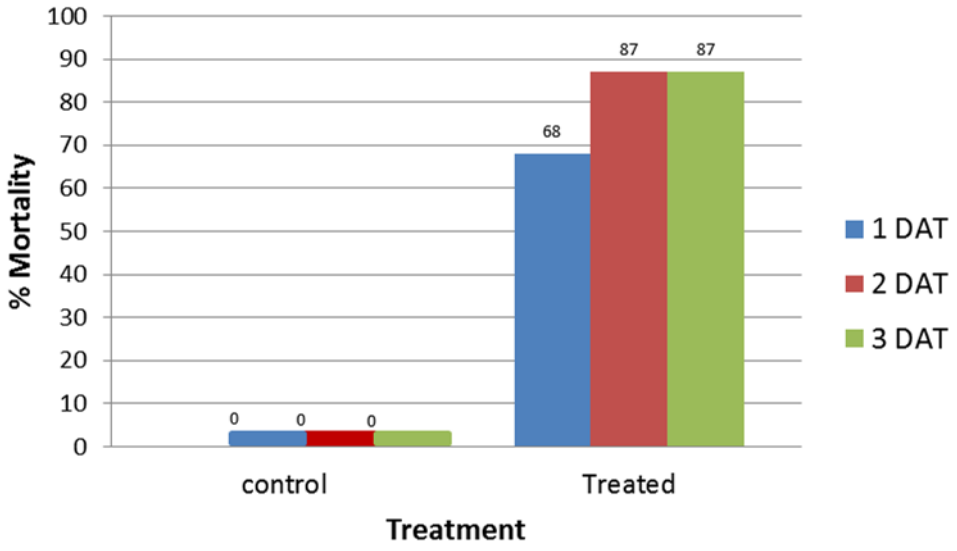
Pyronyl (pyrethrins and piperonyl butoxide) was evaluated as a treatment against coqui frogs. Adult and juvenile coqui frogs were caged individually and sprayed with 4 ml Pyronyl at the highest label rate (2 tsp. or 10 ml/ gal water). While still caged, the frogs were then placed in an aquarium lined with sphagnum moss moistened with tap water, which provided high humidity conditions but no access to free water to prevent the frogs from washing off the Pyronyl. Frogs were observed for mortality for 3 days after treatment.

- Within 24 hours, 68% mortality was achieved; by 48 hours, 87% mortality was achieved among frogs treated with Pyronyl, compared to no mortality among untreated frogs (Fig. 11).
- No further mortality was observed beyond 2 days after treatment.

Pyronyl was sprayed on individual frogs.

After treatment, individually caged frogs were placed on moist sphagnum moss for observation.

Figure 11: *In vitro* Efficacy of Pyronyl against Adult Coqui Frogs.



*Rate: Pyronyl at 10 ml/ gal water (4 ml per frog); Control: tap water (4 ml per frog)

Table 1. Summary of Trial Results - September 2013 – March 2014

ANTHURIUM

Trade Name	Chemical Name	Chemical Group*	Chemical Class for Rotation	Label Site	Application	Melon thrips	Anthurium thrips	Banana rust thrips	Anthurium whitefly
Marathon 1% G	imidachloprid	4A	neonicotinoid	Greenhouse, nursery, interior plantscape	Top dress		**Highly effective**	**Highly effective**	**Highly effective**
Mycotrol O	*Beauveria bassiana*	unknown	microbial	Indoor/Outdoor, green-house, shadehouse	Foliar		Not effective	Not effective	Not effective
Precise	acephate	1B	organo-phosphate	greenhouse, lathhouse, shadehouse	Top dress			**Effective**	Not effective
Pylon	chlorfenapyr	13	pyrrole	Greenhouse only	Foliar	**Highly effective**			
Safari 2G	dinotefuran	4A	neonicotinoid	Greenhouse, interior plant-scape, lathhouse, shadehouse, nursery, outdoor landscape	Top dress		**Highly effective**	**Effective**	**Highly effective**

DRACAENA

Trade Name	Chemical Name	Chemical Group*	Chemical Class for Rotation	Label Site	Application	Hibiscus snow scale	Ambrosia beetle
Decathlon 20SC + Liberate	cyfluthrin, lecithin	3A	pyrethroid, botanical	Greenhouse, outdoor landscaped areas, interior plantscape	Trunk spray		Inconclusive
Discus + Liberate	cyfluthrin, imidacloprid, lecithin	3A, 4A	pyrethroid, neonicotinoid, botanical	Greenhouse, field, container nursery, interior plantscape	Trunk spray		Inconclusive
Distance + Liberate	pyriproxyfen, lecithin	7C	juvenile hormone mimic, botanical	Indoor (greenhouse, lathhouse, shadehouse, interiorscape) and outdoor	Foliar	**Highly effective**	
Kontos	spirotetramat	23	tetronic acid	Greenhouse, nursery, interiorscape	Dip Foliar	Not effective	
Marathon 1%G	imidacloprid	4A	neonicotinoid	Greenhouse, nursery, interior plantscape	Top dress	Not effective	
Onyx + Liberate	bifenthrin, lecithin	3A	pyrethroid, botanical	Outdoors for lawns, ornamental plants, building exteriors	Trunk spray		Inconclusive
Precise	acephate	3A	organo-phosphate	Greenhouse, lathhouse, shadehouse	Top dress	Not effective	
Safari 20SG	dinotefuran	4A	neonicotinoid	Greenhouse, nursery, interior plantscape, outdoor landscape	Dip Trunk spray	**Highly effective**	
Safari 2G	dinotefuran	4A	neonicotinoid	Greenhouse, interior plantscape, lathhouse, shadehouse, nursery, outdoor landscape	Top dress	**Effective**	
Sevin SL	carbaryl	1A	carbamate	Outdoors for turf, ornamental and edible crops, pasture	Trunk spray		**Effective**

PALMS

Trade Name	Chemical Name	Chemical Group*	Chemical Class for Rotation	Label Site	Application	Palm mealybug	Coconut scale
Kontos	spirotetramat	23	tetronic acid	Greenhouse, nursery, interiorscape	Drench	**Highly effective**	Inconclusive
Safari 2G	dinotefuran	4A	neonicotinoid	Greenhouse, interior plant-scape, lath and shadehouse, nursery, outdoor landscape	Top dress	**Highly effective**	Inconclusive
Safari 20SG	dinotefuran	4A	neonicotinoid	Greenhouse, interior plants-cape, lath and shadehouse, nursery, outdoor landscape	Drench	**Highly effective**	Inconclusive

COQUI FROGS

Trade Name	Chemical Name	Chemical Group*	Chemical Class for Rotation	Label Site	Application	Coqui frog
Pyronyl	pyrethrins	3A	pyrethrins	Outdoors and indoors, turf and grass, ornamental and edible crops, pasture	Spray	**Effective**

University of Hawaii at Manoa
College of Tropical Agriculture and Human Resources
Komohana Research and Extension Center
875 Komohana Street, Hilo, HI 96720