Systems Approach to Quarantine Treatments for Export Ornamentals



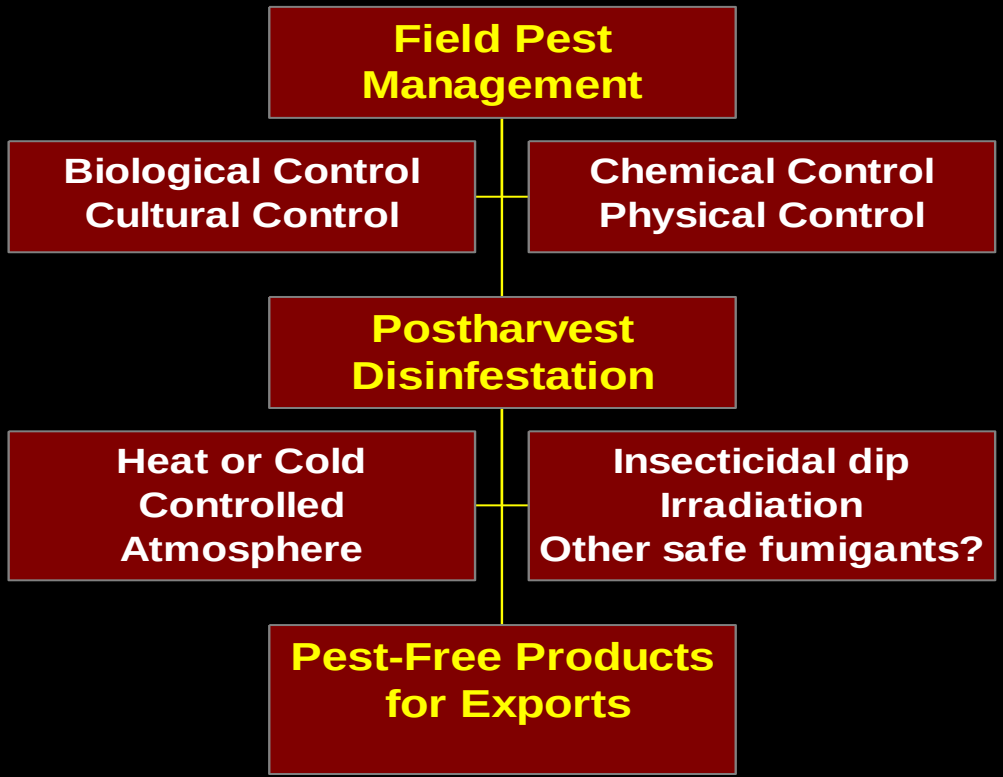


Arnold H. Hara, Entomologist
Beaumont Agricultural Research Center
875 Komohana St., Hilo, Hawaii 96720
E-mail: arnold@hawaii.edu

Systems Approach to Quarantine Security of Floricultural Crops

- an approach to quarantine security that integrates field pest management practices and postharvest treatments into a unified system
- based on the fact that control measures before harvest, such as biological control, can reduce pests to a level at which the postharvest treatment is 100% effective
- producing pest-free products requires low field pest populations that are maintained by field pest management, and when combined with a postharvest treatment, will assure no live pests.

The Systems Approach for Floricultural Crops



Field Control Tactics

- **Cultural Control** - Sanitation by removal of plant parts or plant. Grow healthy plants. Stressed plants are more susceptible to pests.
- **Physical Control** - temperature, water.
- **Mechanical Control** - fly swatter, screening
- **Biological Control** - use of parasites, predators, or pathogens (fungus, bacteria, virus, nematode).
- **Biorational Control** - soaps, oil, insect growth regulators, softer/natural insecticides-neem, pyrethrins, rotenone.
- **Chemical Control** - Malathion, Diazinon, Dursban (OP) and Sevin (carbamate)

Reduced-Risk Insecticides: Insect Growth Regulators - Talus, Distance; systemic neonicotinoids - Marathon, Safari

Evolution of Insecticides

1940-50's

Chlorinated hydrocarbons
DDT, Chlordane, Dieldrin, Mirex

1960-70's

Organophosphates & Carbamates
Dimethoate, Diazinon, Dursban, Orthene

1980-90's

Pyrethroids (synthetic)
Mavrik, Tame, Tempo, Decathlon, Talstar

1990-2000's

Reduced-Risk Insecticides

Natural
Conserve, Avid,
Ultiflora, Neem

Insect Growth Regulators
Distance, Enstar, Talus

Neonicotinoids
Merit, Marathon, Safari, TriStar

POSTHARVEST QUARANTINE TREATMENTS
Cut Flowers & Potted Plants

- Washes (pressure, scrubbing)
- Insecticidal dips (pyrethroids, soaps)
- Aerosols (pyrethrins, resmethrin)
- Thermal Fogs (vaporized insecticides)
- Heat treatments (hot water dip, shower, air)
- Irradiation (Cobalt 60, electron beam)
- Fumigants (~~methyl bromide~~ other safe fumigants?)
- Controlled Atmosphere (high CO_2, low O_2)
- Cold Treatments (coqui frogs, others)

Washes


Potassium soap-based wash and scrub


Pressure washing


Brushing


Wiping

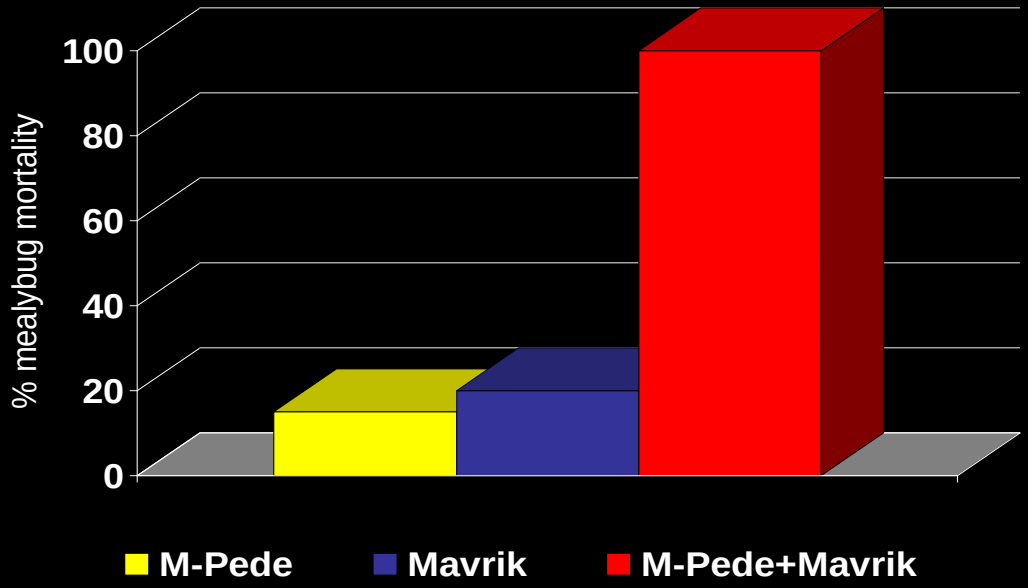
Fogs, Aerosols and Dips

* Aerosols are small droplets <10 µm diam.
* Fogging is achieved by vaporizing insecticide with heat.
* Insecticidal Dip (Mavrik Aquaflow)

Aerosols applied to pincushion protea for thrips control

Thermal fogger

* Mavrik (fluvalinate) is labeled for use as a dip for flower and foliage cuttings.
* Broad-spectrum pyrethroid effective against aphids, leafhoppers, mites, thrips, whiteflies.
* In-tank mix with insecticidal soap (M-Pede), effectiveness against mealybugs is significantly increased.



Postharvest Treatments Against Thrips in Protea

Treatment	AI	No. thrips per flower
Mavrik Aquaflow	0.09 g/l Dip	0c
Raid Aerosol	0.016 g/s	1.2b
Resmethrin fog	20 ml/m^3	9.8a
Water dip		25.7a
Fog control		17.1a
No treatment		17.1a

Heat Treatments for Quarantine Pests

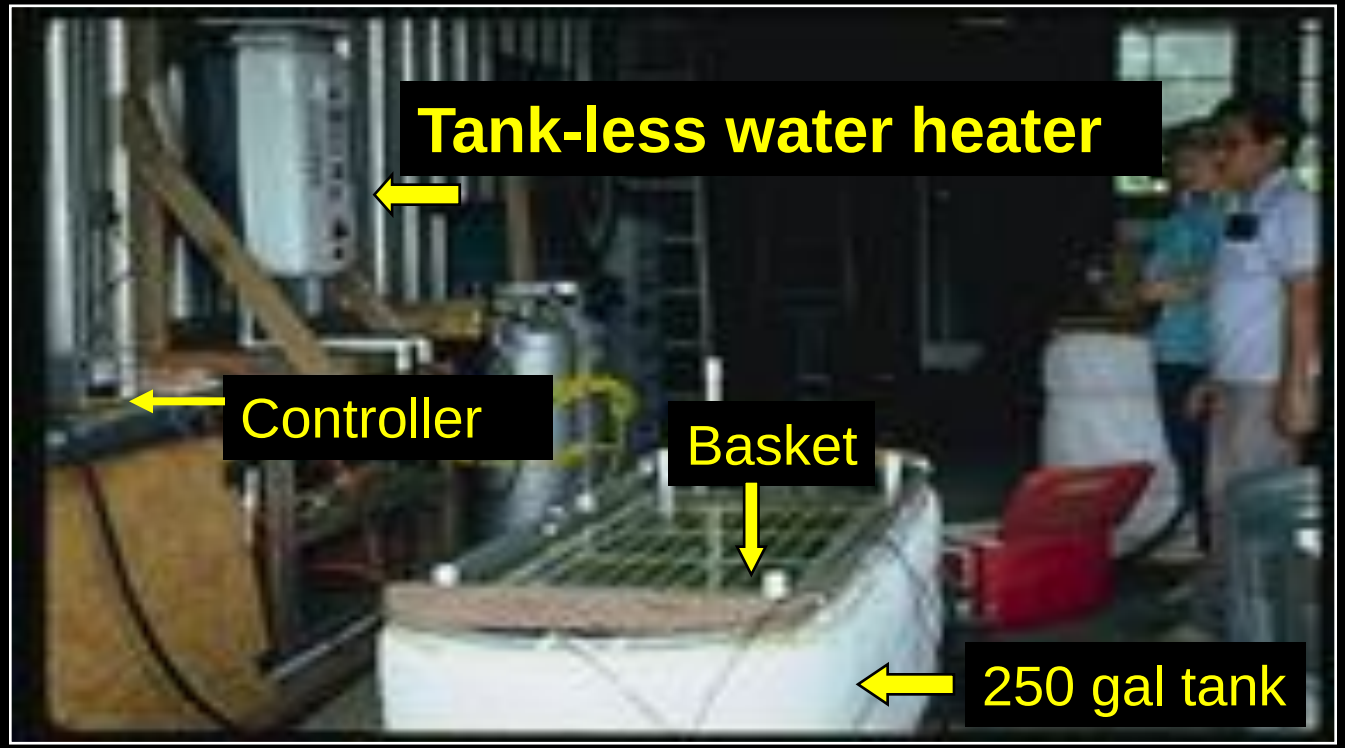
- Heat in the form of hot water was first used to treat seed potatoes for late blight in 1882.
- Heat treatment has been used to disinfest plant materials of insects, nematodes, fungal, bacterial and viral pathogens.
- Heat treatments benefit certain plants by increasing rooting, budding and vase life.
- Plants can be conditioned to tolerate heat treatments.

Insect Mortality at 120º F (49ºC)

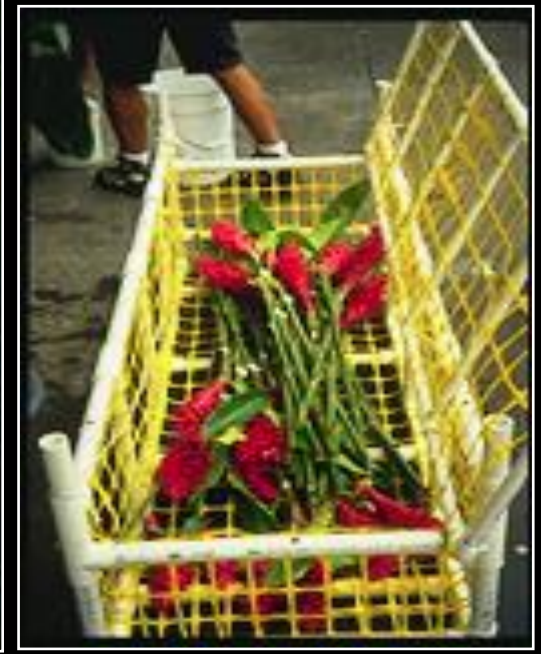
(Insects on or in plant host)

Insect	> 99% mortality (min)
Ant	0.5
Aphids (banana, cotton)	1.0
Taro root aphid	5.5
Cockerell scale (armored)	6.0
Green scale (soft)	7.0
Spiraling whitefly	10.0
Mealybugs	12.0
Burrowing nematodes	15.0
Coqui frog & eggs (109 F)	5.0

Hot-Water Dip Tank



Basket loaded with red ginger



Beneficial Effects of Hot Water

49 C (120 F) for 10 min

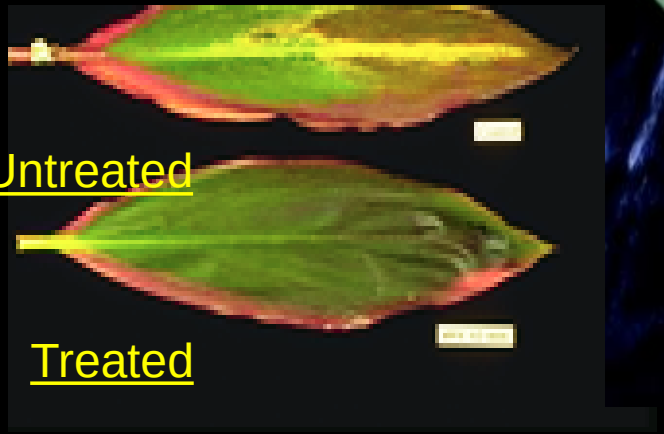
Sexy pink heliconia

PREVENTS ABSCISSION

Treated Untreated

Ti leaves

EXTENDS VASE LIFE
BY CONTROLLING
SPIDER MITES



Red ginger

PREVENTS GEOTROPISM

Treated Untreated

Commercial Installation with Winch to Lift Basket

Hot Water Treament Recognized as Effective by CDFA

Notifies inspector that insects may appear live; hot water preserves soft bodied insects

NOTICE OF TREATMENT

PRODUCTS DIPPED IN HOT WATER

- ☐ Ginger Pink
- ☐ Ginger Red
- ☐ Bird of Paradise
- ☐ Bird Leaves

Palm Leaves:

- ☐ Areca
- ☐ Phoenix
- ☐ Queen Sago
- ☐ Rhapis
- ☐ Ti Leaves

The shipper performed this treatment without official regulatory supervision at origin. Insects killed by this treatment may appear "fresh" or "alive." DO NOT REJECT FOR INSECTS UNLESS IT IS DETERMINED THEY ARE ACTUALLY ALIVE THROUGH AN APPROVED MANNER. IF NECESSARY, CONTACT CDFA'S Pest Exclusion Branch for further information.

FLORAL RESOURCES, INC. HAWAII
175 E. KAWAILANI ST
HILO, HAWAII 96720
PH: (808) 959-5851/FAX: (808) 959-2077

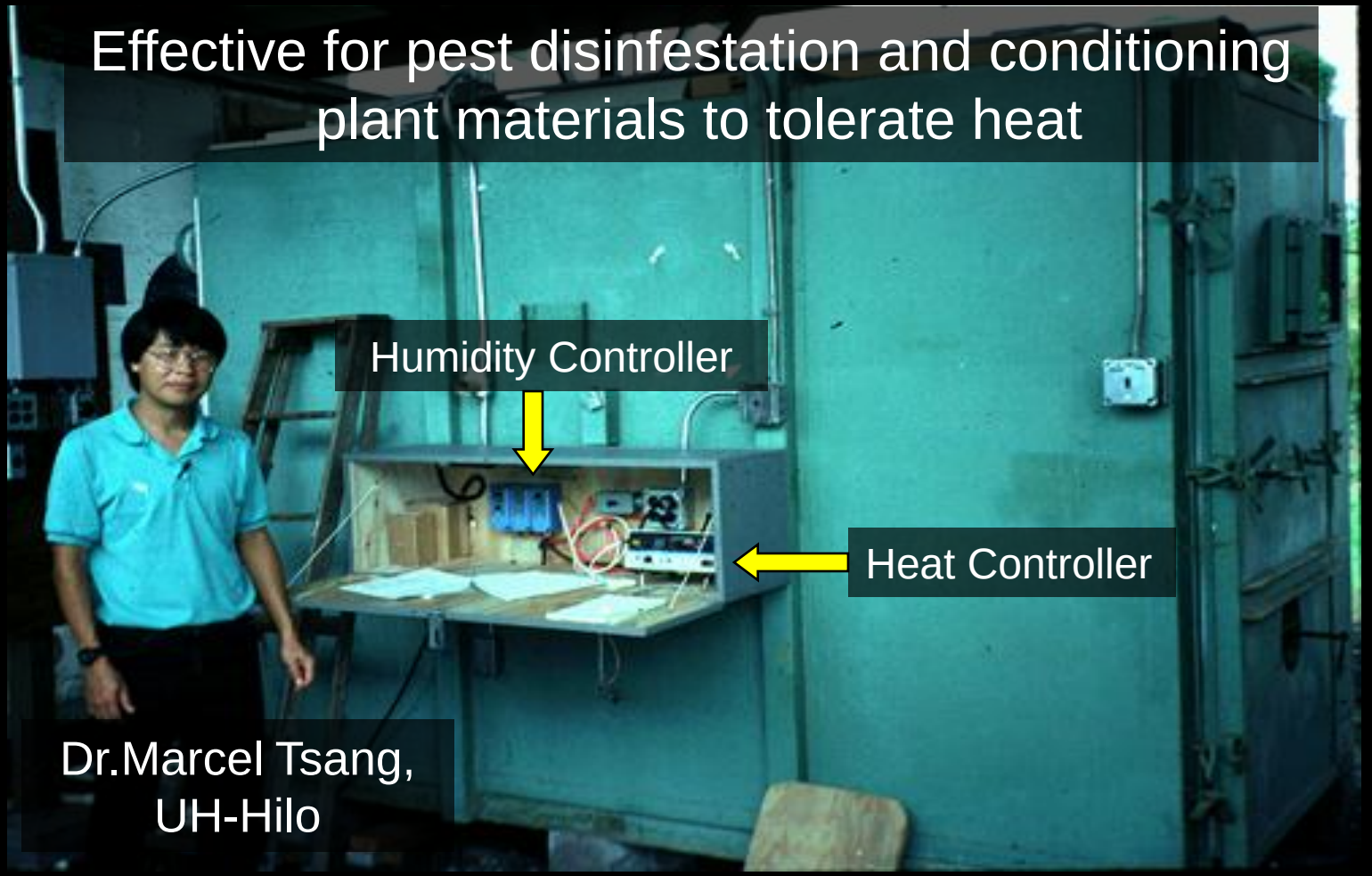
Propagative Materials Treated with Hot Water & Rooting Hormone

(49° C for 10 min + 0.8% indole butyric acid (IBA) rooting powder)

	Number of roots	
	Hot water + IBA	**IBA only**
Dracaena ‘Janet Craig’	2.2	1.1
Dracaena ‘Massangeana’	8.3	3.3
Plumeria	12.4	3.2
Gardenia	118.3	15.6

Former Methyl Bromide Chamber Converted to a Hot-Air Chamber

Effective for pest disinfestation and conditioning plant materials to tolerate heat



Conditioning in Hot-Air to Tolerate Hot-water Dip during Cold, Rainy Season

No conditioning
dipped in hot water

49 C, 12 min

Hot air 39 C, 2h
followed by
hot water dip
49 C, 12 min

Commercial Hot Shower Chamber

used by Hawaii's Nursery Industry

Refrigerated freight container modified to deliver a hot shower (109-120 ºF) via FullJet nozzles at 70 gpm.

Hot water storage tank

80 plants in one load

110 full cone nozzles

113 F for 5 min effective against coqui frogs

HOT WATER TREATMENTS: NON-CHEMICAL CONTROL OF INVASIVE PESTS

All photos by UH CTAHR unless otherwise noted.

HEAT TREATMENT TO KILL PESTS

(lowest temperature, shortest duration to achieve 100% mortality)

Roger Lopez-Chaves

Burrowing nematode **15 min**

Root mealybugs **15 min**

122

Julie Coughlin

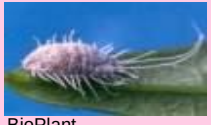
Taro root aphid **5.5 min**

Cockerel scale **6 min**

Green scale **7 min**

Spiraling whitefly **10 min**

Nettle caterpillar (pupa) **7 min** (eggs) **10 min**

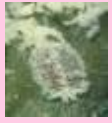


BioPlant

Long-tailed mealybug **12 min**

Kearney Agric Center

Obscure mealybug **12 min**



Pink hibiscus mealybug **12 min**

120

Missouri Botanical Garden

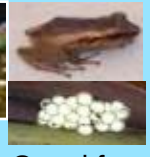
Foliar nematode **10 min**

Nettle caterpillar (larva) **12 min**

117

W Nagamine

Can Food Ins Agency



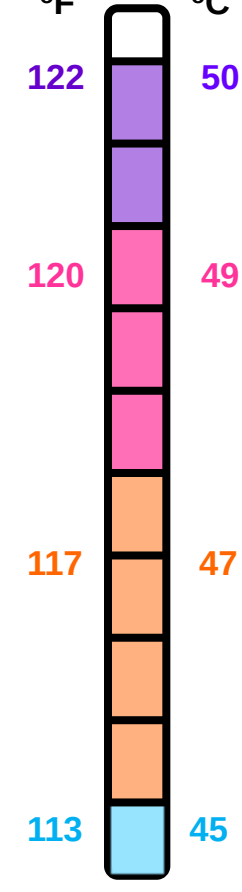
Chrysanthemum white rust **5 min**

Little fire ant Adults **10 min**

Snails adults **15 min**

Coqui frog adults & eggs **5 min** *

113



PLANT TOLERANCE TO HEAT

(highest temperature, longest duration tolerated)

122

Anthurium 'gobo' (propagative material) **10 min**

POTTED PLANTS

6 min: Rhapis palm

10 min: Dracaena 'Massangeana', 'Compacta', Bromeliad 'Tillandsia' Foxtail palm, Croton 'McKenzie'

10 min w/ hot water conditioning at 102 °F (39 °C): Palms: Parlor, Bamboo, Phoenix, Fishtail; Dracaena: 'Janet Craig' and 'L'

120

PROPAGATIVE MATERIAL

- Gardenia
- Ginger, edible
- Plumeria
- Sugarcane
- Dracaena: cutbacks: 'Massangeana', 'Jumbo', 'Warneckii', money tree tip cuttings: 'Janet Craig', 'L'

CUT FLOWERS & FOLIAGE

- Bird-of-paradise buds, foliage
- Calathea foliage
- Red ginger
- Heliconia flowers (16 cv, var.)
- Palm foliage
- Papyrus foliage
- Ti leaves
- Whaleback foliage

10 min

Orchid Oncidium Sharry Baby 'Sweet Fragrance' **10 min**

Orchid Vuylstekeara Michelle Rehfield 'Pacific Blue Skies' **5 min**

117

Chrysanthemum 'Cupertino' 'Manhattan' **10 min**

Bromeliad Vriesea: 'Flammea','Purple cockatoo', *V. cocorvadensis*

Dracaena 'Pele' 'Warneckii' 'Rikki' **12 min**

Bromeliads Guzmania 'Fiesta', 'Marjam'. 'Puna Gold' **5 min**

Ornamentals 'Awa, Canna lily, Chrinum, Dieffenbachia, Dracaena 'Tricolor coloramma', Easter lily, Kalanchoe, Odorata, Philodendron, Schefflera, Salvia, Stromanthe, Tricolor stromanthe, Zamia, Norfolk Pine

Landscape Bougainvillia, Kupukupu fern, Lantana, Laua`e fern, Liriope var., Plumbago, Podocarpus, Ti 'Kaua'i' Zoysia grass

Orchids Dendrobium 'Din Daeng Bl 'eggy Ruth Carpenter 'Jem', Epicat Hilo Delight 'Starlight'

113

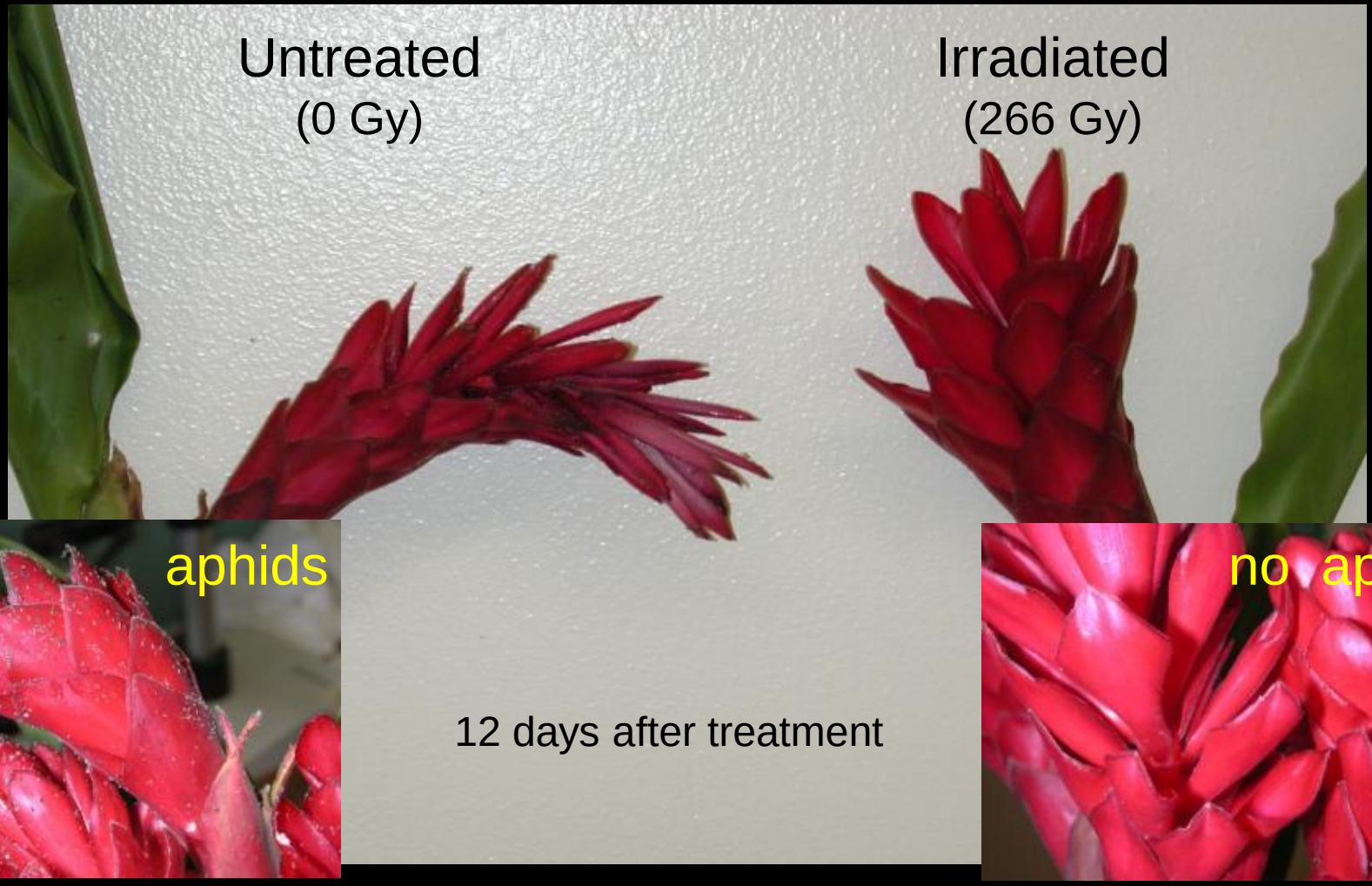
rev 01/2011

“Father & Son” of Irradiation in Hawaii

Lyle Wong & Peter Follett
HDOA USDA

- Irradiation at 250-400 Gy is an effective disinfestation treatment not only for fruit flies, but for mealybugs, psyllids, thrips, weevils & scale insects causing sterility and halting development.
- An X-ray irradiation facility was completed in July 2000 in Hilo, Hawaii.
- A second irradiator is planned for Oahu.

Irradiation as a Quarantine Treatment

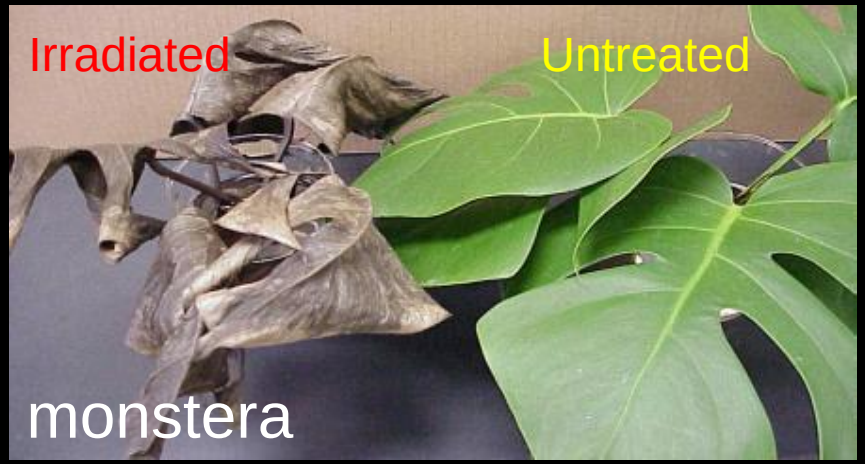


Untreated (0 Gy)

Irradiated (266 Gy)

5 days after treatment

Tropical Cut Flowers and Foliage Irradiated at 430 Gy

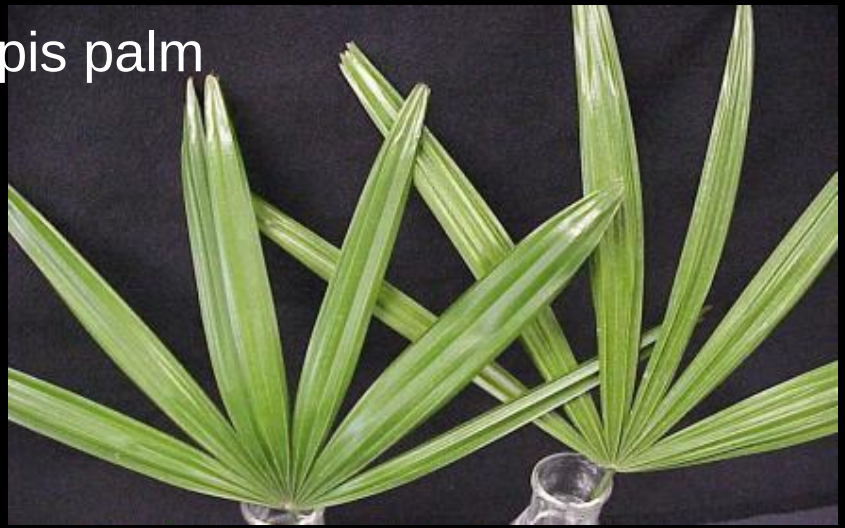


Tropical Cut Foliage Irradiated at 430 Gy – No Damage

Lauae Fern

Lycopodium

Rhapis palm



Green ti

Ornamentals disinfested by irradiation without reducing product quality

- Cut flowers and foliage

  Temperate (imports)

  Carnation, chrysanthemum (sugar preservative required), rose, gerbera, gladiolus, gypsophila, Christmas trees (Sensitive: Lilies, iris)

  Tropical: (exports)

  Dendrobium and oncidium orchids, ginger flower, ti-leaf

  Sensitive: anthuriums, king protea, certain heliconia

- Potted Plants

  Preliminary tests demonstrates that potted plants (gardenia) are killed by irradiation.

- Propagative Materials

  Live shoots will probably be damaged.

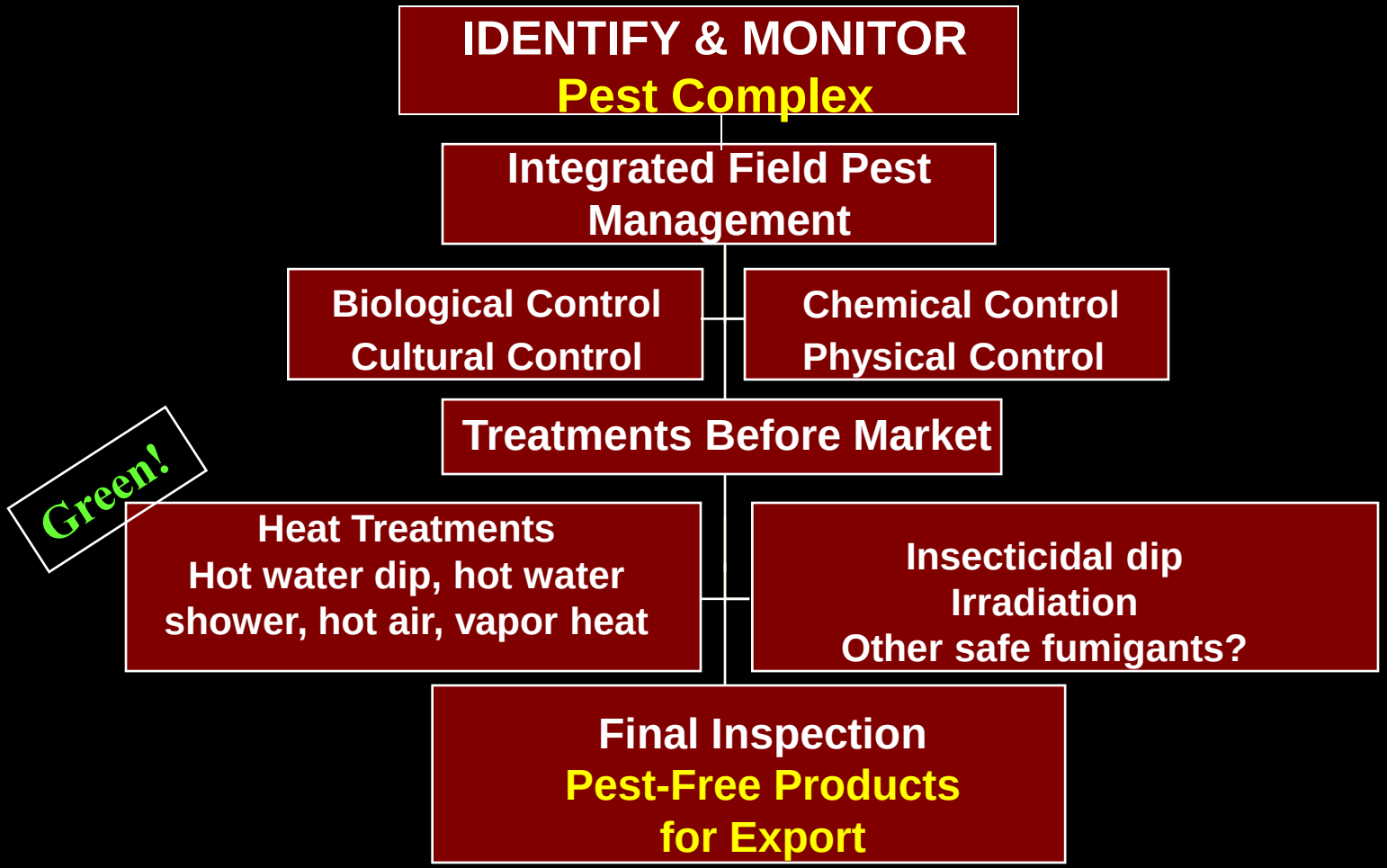
No Silver Bullet for Pest-Free Ornamentals

- **Field Control (Biological, Chemical,Cultural,Physical)**
- **Washes and Chemical Dips**
- **Fogs and Aerosols**
- **Heat Treatment**
- **Controlled Atmosphere**
- **Irradiation**
- **Systems Approach!!!**

Field pest management and a postharvest treatment

Overall Control Strategy

The Systems Approach




A BIG THANK YOU!
For assistance:
Pete Ballerini
Kris Aoki
Brian Bushe
Susan Cabral
Pat Conant
Peter Follett
Reggie Hasegawa
Clyde Hirayama
Ben Hu
Christopher Jacobsen
Eric Jang
Jon Katada
Charles Nelson
Ruth Niino-DuPonte
Kyle Onuma
Marcel Tsang
08 Feb 14