Research Supporting Tropical Fruit Growers in the U.S. Pacific Basin

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CORE STRENGTHS

• Pest and disease management, invasive species
• Tropical germplasm preservation, genetic resources
• Postharvest technologies, quarantine treatments, value-added products
Invasive pest species

Biology, ecology, genetics
Detection and mitigation
Biological control
Management & suppression
Invasive Fruit Flies

Over 100 years in Hawaii

Oriental fruit fly

Melon fly

Med fly

Solanaceous

Area-Wide Pest Management
Detection & Chemical Ecology
Biological Control
Ecology and Behavior
Genetics, SIT, Mass Rearing
Invasive Pests
AW-IPM for Coffee Berry Borer

Provide growers with real-time data on CBB populations and weather, plus recommend optimum control at diverse landscapes.

- Beauvaria bassiana
- Sanitation
- Strip picking
- Pruning
- Predators
- Parasitoids
- Nematodes

16 sites in Hawaii & Puerto Rico
Tropical Germplasm Preservation

- Preservation of 14 crops.
- Collection is ~1000 accessions maintained as living plants, in tissue culture and in greenhouses.
- Includes pineapple, papaya, lychee, rambutan, starfruit, breadfruit, guava, acerola cherry, macadamia and pili nut.
National Clonal Germplasm Repository
Major Crops

Ananas comosus (pineapple)
Artocarpus altilis (breadfruit)
Averrhoa carambola (starfruit)
Bactris gasipaes (peach palm)
Canarium ovatum (pili nut)
Carica papaya (papaya) and relatives
Dimocarpus longan (longan)
Litchi chinensis (lychee)
Macadamia integrifolia (macadamia)
Malpighia glabra (acerola)
Nephelium lappaceum (rambutan) and
N. ramboutan-ake (pulasan)
Passiflora edulis (passion fruit)
Psidium guajava (guava)
Flowering of Tropical Crops

Flowering completed ~12 weeks
Breeding for “Freckle free” papaya in Hawaii

Goal: Combine great taste and PRSV resistance from Hawaii papayas with “freckle free” appearance

Hawaii papayas with freckles

“Freckle Free” papayas from Brazil

“freckle free” grown in Hawaii as parent plant for crosses
Symptoms: Leaf chlorosis, necrosis, leaf twisting, and leaf drop

Potential fungal pathogens recovered from roots/soil (1) and fruit (2):
(1) *Phytophthium* sp. (possibly *vexans*): has a wide host range including bananas, Citrus, papaya, ohia, avocado, many vegetables; is favored by excessive root moisture caused by poor drainage.

(2) *Cylindrocladiella* sp. (possibly *lageniformis*): This genus contains many species which cause root and stem rots (possibly as weak pathogens).
Postharvest Technologies

- Phytochemical & nutritional analyses
- Postharvest physiology, storage & handling
- Quarantine treatments
Noni juice: biochemical composition & anti-tumor activity

- Fermented noni juice has anti-tumor activity through activation of both innate and active immune responses.
- Noni juice delivered orally to mice enabled tumor rejection, as well as eradication of existing tumors.

- Microbial changes
- Sugars, organic acids, ethanol
- Volatiles (13 + 4 novel esters)
- Fractionated for potential anti-tumor compounds
Hypobaric storage
• Cold storage of fruit under partial vacuum
• Low O2 partial pressure
• Reduce ethylene & respiration rates
• Potential for high-quality fruit after months of storage. Double or triple shelf-life.
Postharvest Technologies

Hypobaric storage

Hypobaric (2.7 kPa) treated mangos after storage for 28 days at 13°C.
Hypobaric storage

Cherimoya after 13 days

Control (100kPa)  Hypobaric (2.7kPa)

Cherimoyas after hypobaric storage for 20 days (L), ripe fruit at day 23 (R)
Market Access: Quarantine Treatment Technology

- Heat
- Cold
- CA/MA
- Hypobarics
- Radiation (X-ray)
- Systems Approach
# Market Access

Quarantine treatments for Hawaii exports

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Treatment</th>
<th>Fruit</th>
<th>Treatment</th>
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<tbody>
<tr>
<td>Abiu</td>
<td>I</td>
<td>Jackfruit</td>
<td>I</td>
</tr>
<tr>
<td>Atemoya</td>
<td>I</td>
<td>Longan</td>
<td>I, H</td>
</tr>
<tr>
<td>Avocado</td>
<td>F, S (Sharwil)</td>
<td>Lychee</td>
<td>I, H</td>
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<tr>
<td>Banana</td>
<td>I, N</td>
<td>Mango</td>
<td>I</td>
</tr>
<tr>
<td>Breadfruit</td>
<td>I</td>
<td>Mangosteen</td>
<td>I</td>
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<tr>
<td>Capsicum spp.</td>
<td>I</td>
<td>Moringa</td>
<td>I</td>
</tr>
<tr>
<td>Carambola</td>
<td>I</td>
<td>Papaya</td>
<td>I, H</td>
</tr>
<tr>
<td>Citrus</td>
<td>I, H</td>
<td>Pineapple</td>
<td>I, N, H</td>
</tr>
<tr>
<td>Cucurbita spp.</td>
<td>I</td>
<td>Rambutan</td>
<td>I, H</td>
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<tr>
<td>Dragon fruit</td>
<td>I</td>
<td>Sapodilla</td>
<td>I</td>
</tr>
<tr>
<td>Durian</td>
<td>N</td>
<td>Sweet potato</td>
<td>I, F, H</td>
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<tr>
<td>Eggplant</td>
<td>I</td>
<td>Tomato</td>
<td>I</td>
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<tr>
<td>Guava</td>
<td>I</td>
<td>Cowpea</td>
<td>I</td>
</tr>
</tbody>
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I = irradiation, C = cold, N = non-host status, S = systems approach, H = heat (hot water immersion or vapor heat), F = fumigation.
MAHALO

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