IPM stands for Integrated Pest Management
Aquaponics ≠
No Pest Problems
Integrated Pest Management

* The use of **all possible pest control methods** in a well organized and harmonious way in order to achieve **long term** pest control.
Components of IPM

- Chemical Control
- Biological Control
- Biotechnology
- Cultural & Physical Control
- Habitat Modification
- Pest ID & Monitoring

Integrated Pest Management
Why use IPM?

- The primary goal of IPM is to retain or improve production without negatively impacting the environment and human safety.
Pest Identification

- Proper identification
- Utilize correct pest control techniques
**Common Types of Pest: Chewing**

- **Chewing Pest:**
  - Feeding on the foliage, stems, fruit or roots.
  - Pests within this group include beetles, caterpillars, earwigs, leaf miners, etc.
Sucking Pest

- Pierce plant's vascular tissue and withdraw plant sap.
- Cause plants to discolor, twist and distort.
- Often vectors and excrete attractive honeydew that turns black with the formation of a fungal sooty mold.
- Pests within this group include aphids, grasshoppers, whiteflies, mealy bugs, scales and leaf hoppers.
Common Types of Pest: Mites

- **Mites:**
  - They have rasping and sucking mouthparts similar to thrips
  - Result in a brown to russet discoloration of leaves, stems, fruit and flowers

Photo credit: Dr. Ted Radovich, Dr. Scot Nelson & Jari Sugano
Common Types of Pest: Ants

- **Ants**
  - They are honeydew consumers and protect pests from natural enemies
  - Promotes sooty mold development
  - Sugar loving ants vs. grease loving ants

Photo credit: Dr. Scot Nelson & Jari Sugano
Common Types of Pests: Fruit Flies

* **Fruit Flies**
  * Adult females sting fruits and vegetables resulting in blemishes
  * Larvae tunnel within fruit
    * Oriental fruit fly, Melon fly, Mediterranean fruit fly, Malaysian fruit fly

Photo credit: USDA ARS
Common Types of Pests: Slugs

- **Snails and Slugs:**
  - Problem for low-growing vegetables
  - Active in the evenings and are commonly associated with seedlings magically disappearing overnight
**Common Types of Pests: Nematodes**

* Nematodes
  * Roundworms that attack garden plants
  * Attack the root system of plants and impair water and nutrient uptake
  * Symptoms: stunting, poor plant growth, narrow and weak stems, foliar chlorosis, root rotting and galling, and plant toppling.

Photo credit: Dr. Scot Nelson
Common Types of Pests: Diseases

- Fungus, Bacteria, Virus, Phyto-plasma, etc
- Plant diseases caused by pathogens

Photo credit: Dr. Janice Uchida, Chris Kadooka & Jari Sugano
Common Types of Pests: Weeds
Nutrition CSI
Monitoring:
Common Tools

- Sticky traps
- Pheromone traps
- Light traps
- Sweep nets
- Observations
Why is Monitoring Important?

- Assess pest population levels
- Determine pest activity
- Track changes over time
- Create field history
What to Look For

- Pest population
- Level of infestation
- Plant location
- Natural enemies
- Time of year
- Contributing conditions
- Environmental conditions
Established levels that a pest population must reach before implementing pest control treatments
Pest Control in IPM Systems

- Treatments based on monitoring data
- Control measures are used after action threshold is surpassed

Action level

Population building

Apply control treatments
IPM
Control Strategies
Least toxic approach first
Control: Habitat Modification

* Eliminate pests breeding sites
* Eliminate favorable conditions
  * Pest / disease build up
  * Removal of food or habitat sources
Eliminate breeding sites
Eliminate favorable conditions.
Control: Physical Measures

- Installation of physical barriers or devices to disadvantage the pest
  - Screens
  - Barriers
  - Sprinkler systems
  - Wires
Copper Wires
Control: Cultural Modifications

- Manipulation of cultural practices to disadvantage the pest
  - Crop rotation
  - Fallow periods
  - Crop spacing
  - Companion planting
  - Crop selection
  - Aeration
  - Worms-nutrition
Utilize monitoring data to develop field history.
Companion planting

Photo credit: orchidflowers.wordpress.com
Biological Controls

The use of natural predators, parasites, pathogens, etc. to control pests.

Example: ladybugs, predatory insects.
Control: Biotechnology

- Selective breeding (hybridization)
- Application of scientific techniques to modify and improve plants, insects and pathogens
Variety selection

Tygress

Xaman

Pik Ripe 461

Toqui

VT-62966

VT-62940

Tovi Roca

Tovi Star

Kewalo

Sunchaser

Sunsugar

Adonis
Pesticide Applications: Crop Protection Chemical Control
Control: Chemical Applications

- Typically considered after other control methods
- Low toxicity chemicals are considered first
- Selective vs. broad spectrum chemicals
- Rotated with other chemicals (resistance)
What is a pesticide?

* Chemical used to prevent, destroy, or repel pests
The Label is the Law

1. **ACARAMORT**
   - Product Name
   - Agricultural Miticide
   - Recommended for Agricultural Use Only

2. **Composition**
   - Active ingredients: (% by weight)
     - Propargite (2-0-tert-butylphenyl)-2 cyhloropicpyltox): 73.0%
     - Inert ingredients: 27.0%
   - Total: 100.0%

3. **AGROCOQUEM INTERNATIONAL**
   - EPA Registration Number

4. **KEEP OUT OF REACH OF CHILDREN**
   - Danger • Peligro
   - Signal Word

5. **Statement of Practical Treatment**
   - First Aid
   - If in eyes: Immediately flush eyes with plenty of water. See a physician.
   - If inhaled: Remove person to fresh air. Apply artificial respiration if symptoms indicate. Call a physician.
   - If on skin: Wash thoroughly with soap and water. Get medical attention.
   - If swallowed: Do not induce vomiting. Drink promptly a large quantity of milk, egg whites, or gelatin solution. If these are not available, drink large quantities of water. Avoid alcohol. Call a physician or Poison Control Center immediately.

6. **Precautionary Statements**
   - Hazardous to Human and Domestic Animals
   - Danger
   - Corrode, cause eye damage. May be fatal if inhaled. Harmful if swallowed or absorbed through skin. Do not breathe vapors or spray mist. Do not get in eyes, on skin, or on clothing. Wash hands and face thoroughly with soap and water after use and before eating, drinking, or smoking.
   - Personal Protective Equipment

7. **Applicators and Other Handlers Must Wear:**
   - A long-sleeved shirt and long pants.
   - Chemical-resistant gloves such as Nitriile, Butyl, barrier laminated neoprene rubber, polyvinyl chloride, or viton.
   - Shoe plus socks.
   - Protective eye wear:
     - Chemical-resistant headgear for overhead exposure.
     - Chemical-resistant apron when cleaning equipment, mixing, or loading.
   - Dust/mist filtering respirator (MSA/NOSH approval number prefix: TC-210) or a NIOSH approved respirator with any R, P, or HE filter.
   - Applicators, if applying more than 2 points of ACARAMORT per acre in an aerial equipment to citrus, must be in an enclosed cab.
   - Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them. Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry. When handlers use closed systems, enclosed cars, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.60(b)(6)(iv)(A)), the handler PPE requirements may be reduced or modified as specified in the WPS.
Pesticide Laws in Regards to Aquaponics

- Pesticides in aquaculture/hydroponic systems are allowed:
  - Label language **does not** prohibit it
  - Crop is listed on the label
Crop needs to be listed on the label

* Make sure your crop is listed on label
If there is a reference that the pesticide is harmful to fish, then be aware of consequences if used.

**ENVIRONMENTAL HAZARDS**
This product is hazardous to fish and aquatic invertebrates.
For Terrestrial Uses: Do not apply directly to water, or to areas where surface water is present, or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater or rinsate.
New Pest and Diseases Coming into the Islands
(http://hawaii.gov/hdoa/pi/ppc/npa)
Integrated Pest Management

Components of IPM

- Chemical Control
- Pest ID & Monitoring
- Habitat Modification
- Cultural & Physical Control
- Biotechnology
- Biological Control

Cultural & Physical Control
Benefits of IPM

- Effective
- Flexible vs. routine
- Informed decision makers
- Potential cost savings
- Environmentally responsible
- Enhances worker and workplace safety
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