

Vision:

- Hawaii as an ecological/ environmental state
- A center of biodiversity and organic/ecological farming
- **Hawaii as a high-end tourist destination to enjoy the environment, the arts, its culture, and food.**



Organics In Hawaii

- Increase self-sufficiency in state
- **Boon for Tourism Industry** (popular in Japan, Europe, W. US).
- High-value product for farmers
- **Protect our environment**
- **Protect farm labor, family farm, consumers**
- **Excellent training for students**



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University of Hawai'i at Mānoa

**Give the Customer a Reason to
Do Business with You**

**Don't Just Satisfy the Customer;
"Delight" the Customer**

Exceed the Expectations



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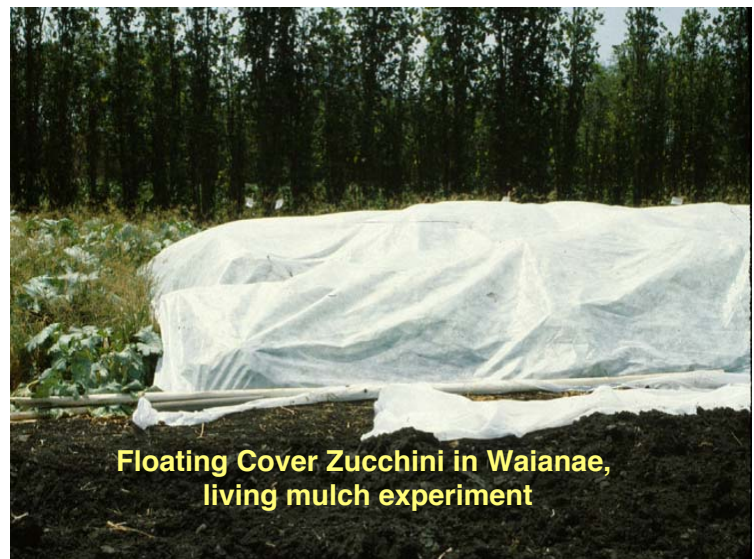
Strategies to deal with **risk**

- Develop a business plan
- Form or join a marketing cooperative
- Direct marketing
- Diversification
- Off-farm employment
- USDA FSA emergency assistance
- Follow "good ag practices"



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Broccoli in tunnels
Physical barriers to keep insects out



**Floating Cover Zucchini in Waianae,
living mulch experiment**

Nutrient management for disease control

- Calcium (disease & physiological- blossom-end rot)
- Silicon additives
- High Organic Matter
- Moderate N levels
- overall balanced nutrition



Systemic induced resistance

- Plant defense mechanism in response to pest attack
- Described for pathogens in 30 species and insects in 100 species.
- Effective in defense against fungi, followed by bacteria and then viruses.



Systemic induced resistance

- Elicited by pest attack or by growth promoting rhizobacteria, composts, compost extracts, chemicals (such as oxalic acid from spinach/rhubarb)
- 16 soil growth promoting bacteria have been identified to induce systemic induced resistance
- Inducing agent must be reapplied



Chitosan (biolizer, Eco-Poly)

- Deacetylated chitin, structural component of some fungi, insects, crustaceans, shell fish, crab shell
- Acts as a natural fungicide and also induces local and systemic resistance against infections caused by viruses (TMV), and diseases



Chitosan, has controlled..

- anthracnose, papaya (Bautista-B. 2003)
- fusarium, tomato (Borges 2000), celery (Bell 98), as seed trt or soil amendment (Hallman 99)
- botrytis, cucumber (Ben-Shalom, 2003)
- fus crown & root rot (Benhamou, 94)
- phytophthora citrus, avocado
- Bean & peanut rust (Yuen et al, 2001)
- Chitinases also produced by plants in response to pest attack



Organic farmer quotes

“In 20 years I think I had to spray a pepper crop once.”

(Steve Mong, Applefield Farm, Mass, 2003).



Growers use insecticides

- Sulfur dust (russet mites)
- soap/ Pyrethrin (aphids)
- Bts (caterpillars)
- diatomeaceous earth
- mineral oils
- beneficials
- insectary plantings



Bacillus thuringiensis

- caterpillar control
- good only against chewing larval stages
- short-life span on the foliage
- Dipel DF, Javelin WG, Xentari, Agree WG

Note: Some Bt products contained prohibited products or are genetically modified, and are not allowed.



Naturalis (Beauveria bassiana)

- A naturally-occurring fungal pathogen of insects
- Under warm and humid conditions, spores germinate, penetrate the cuticle, and produce toxins that kill the insect
- aphids, ants, armyworms, caterpillars, leafhoppers, mites, whiteflies
- Naturalis, Mycotrol



Soaps

(potassium or sodium salts of fatty acids)

- M-pede, Safer
- contact insecticides to control soft bodied insects (aphids, thrips, whiteflies, leafhoppers, small caterpillars, mites).
- Need good coverage and repeated applications, only acts while wet



Spinosad (Entrust)

- Derived from a fungus that is pathogenic to insects, affects the nervous system leading to paralysis, cessation of feeding withing minutes
- caterpillars, beetles, thrips, leafminer
- fruiting vegetables, brassicas, cucurbits
- insect resistance is a consideration
- GF-120 NF Naturalyte Fruit Fly Bait



Surround WP (Kaolin clay)

- fine white clay, disturbs insects' visual and tactile cues, adheres to insects
- particle film technology, microscopic particles form a barrier film to protect from insects and solar damage
- soft bodied insects, beetles, flea beetles, thrips onions, Mediterranean fruit fly (Mazor and Erez, 2004, reporting almost 'complete control')
- wear a mask and respirator to protect from inhalation



'Envirofeast' (Australia)

- Food supplement to increase predator : pray ratio
- complex carbohydrates/protein supplements
- Attract, retain, and conserve beneficials
- alfalfa intercrop in cotton used as refugia and trap crop for mirids (Creontiades)
- conventional plots exterminated predators
- Predatory beetles, bugs, lacewings (Mensah, 1997; M & Khan, 1997; M & Singleton, 2003).



Sulfur, cont.

- Control include anthracnose, scab, powdery mildew, rust, phomopsis, and others. Most effective when applied just prior to and during infection.
- Also controls hatching eggs of scale insects, aphids, and mites.
- Can damage predatory mite populations
- Crop injury may result if sprayed on expanding foliage, and for some crops at temperatures above 85F.
- Incompatible with oil within 2 weeks of an oil application.



Compost tea presumably coats leaves with antagonistic fungi and bacteria and/or provides a nutritional stimulation to leaves, flowers, and fruit and thus prevents foliar disease infection.

Timing of spray applications is important.



Baking soda (sodium bicarbonate)

- Use first published in 1933
- Sprays control a range of foliar diseases
- Contact activity.
- It works through a combination of osmotic pressure, pH, disruption of fungal cell walls and the effects of specific carbonate and bicarbonate ions.



Baking soda

- (& Sunspray oil) Prevent the spread of powdery mildew, Alternaria leaf blight, gummy stem blight and anthracnose on cucurbits.
- Timing and rate of application is important.



Baking Soda & Sun Spray oil

- A recipe is 1.3 lbs. of baking soda and 1.3 pints of Sun Ultrafine Oil mixed with 100 gals. of water.
- powdery mildew control in tomato



Soil Disease Control Products

RootShield (T-22) Trichoderma- strain of beneficial fungus that colonizes roots better than any other fungus known, transplants/field. Most effective to prevent yield loss when some environmental factor prevents the roots from fully exploring the potential root zone.

Drench may be more effective than granular.

Used by many transplant growers. +

Eg **pythium control**



Trichoderma soil/seed treatments

- Plant Shield
- Root Shield
- T-22 HC
- **Pseudomonas** seed bio-priming in pearl millet: increased plant growth, early yield, and resistance to downy mildew. (Niranjan et al, 2004).
- Pseudomonas & neem cake: controlled Fusarium wilt in banana (Saravanan et al., 2003).



Serenade, Bacillus subtilis

- Powdery mildew, downy mildew, bacterial spot of tomato, Botrytis.
- First foliar applied bacillus based biofungicide
- Broad spectrum of disease control.
- Increased yield of garlic when used as a seed treatment/in furrow spray (0.5 lb/cwt).



Postharvest Fruit Rot Management

- Aspire biofungicide *Candida oleophila* yeast- (testing for efficacy is required)- fungi control, Botrytis, penicillium
- Bio-Save 10/1000- Pseudomonas
Cover the fruit with beneficial organisms that compete for nutrients and space at the site of wounds in fruits.
- Plant extracts eg: papaya, custard apple against: Rhizopus, Colletotrichum during storage of mango (Bautista-B et al., 2003).



Insect natural enemies can be:

predators

parasitoids

pathogens

Cotesia glomeratus



Lady beetle eggs



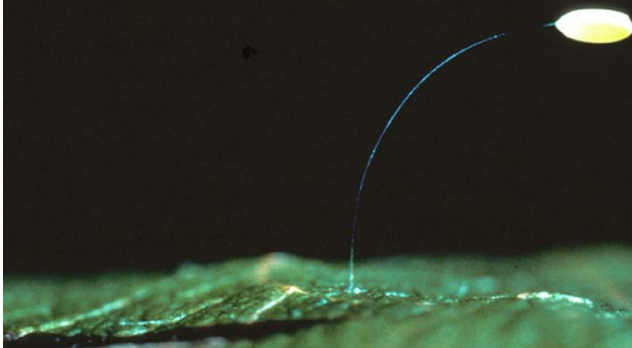
Larvae of seven-spotted lady beetle



Green lacewing adult



Green lacewing egg



Green lacewing larvae, feeding on cabbage aphid



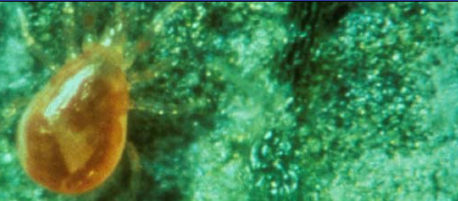
Hover fly adults (syrphid flies)



Hover fly larva



**Predatory mites, Neoseiulus cucumeris
a thrips predator**



Crab spider feeding on insect



**Parasitic wasp on imported
cabbageworm pupa**



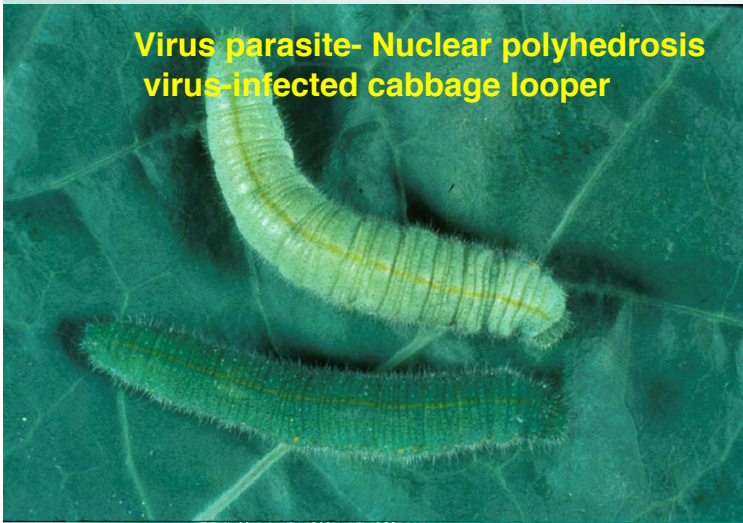
**Braconid wasp, a Cotesia adult over an imported
cabbage worm larvae**



**European corn borer killed by
Bt Bacillus bacteria**



Virus parasite- Nuclear polyhedrosis virus-infected cabbage looper



Fungal parasite infecting a fly



Fungal parasite on an aphid in corn



Insect-attacking Nematodes



Bacteria in nematode gut attacks insect

