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

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”

Give the Customer a Reason to Do Business with You

Don’t Just Satisfy the Customer; “Delight” the Customer

Exceed the Expectations

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.

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 induced 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 rt tom (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)
- diatomaceous 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 (Beauvaria 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

- 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 & Suns 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
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

Soil Disease Control Products

- 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 sevenspotted 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