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Biodiversity: The Clarksville Organic Apple Project

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Organic Apple Team

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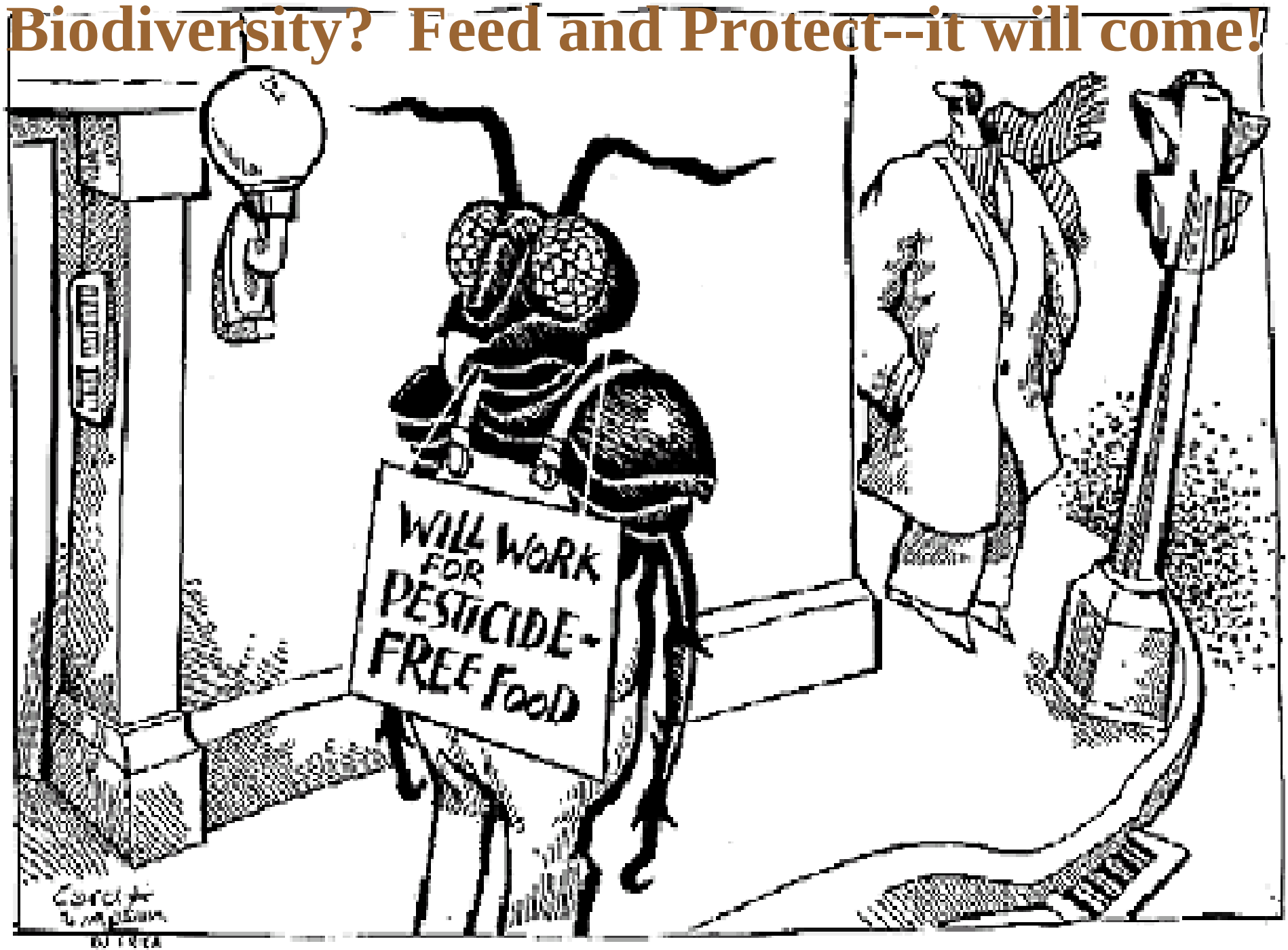
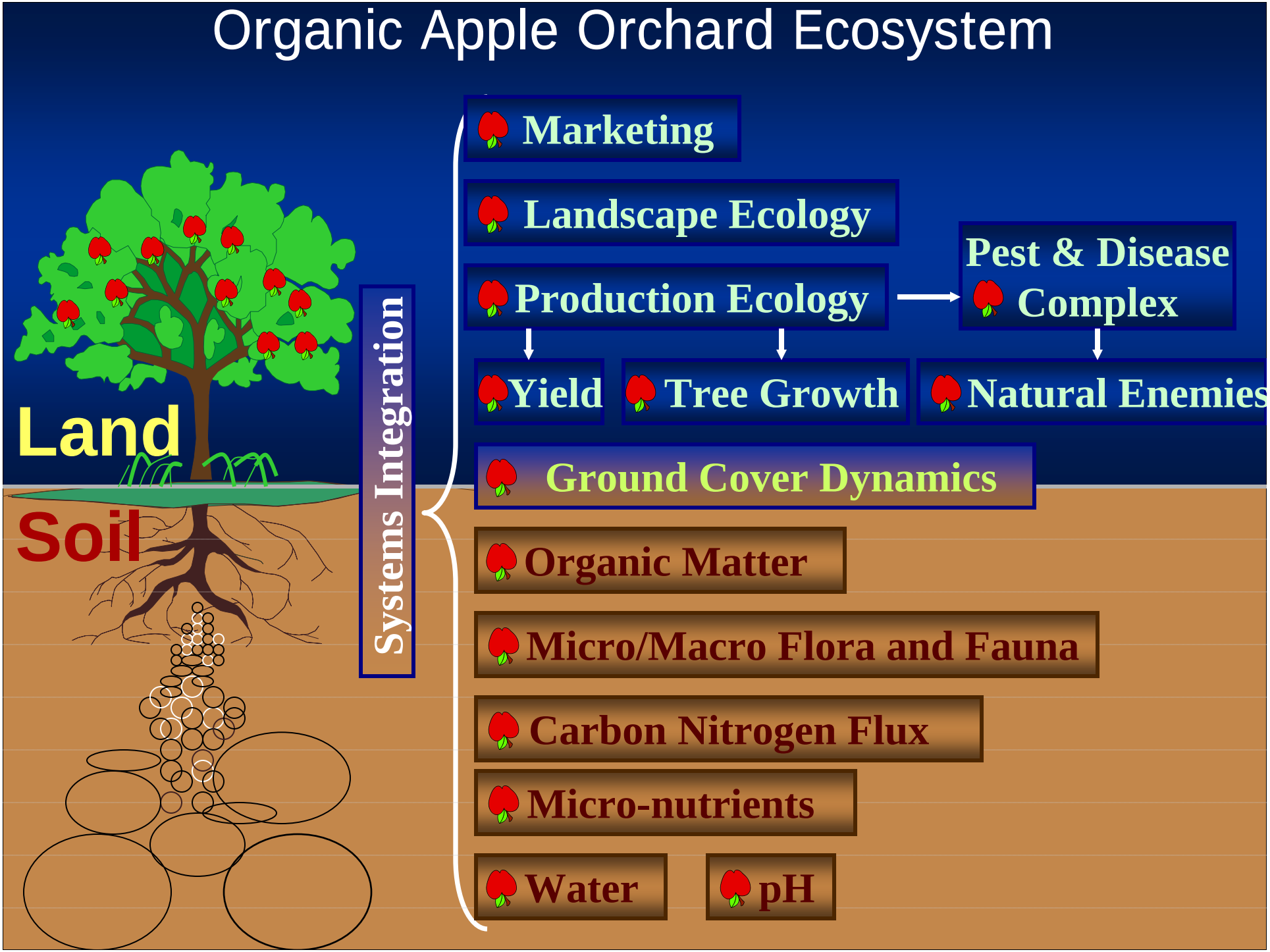
BECKY GORE

Many Organic Input Suppliers

Biodiversity? Feed and Protect--it will come!



Organic Apple Orchard Ecosystem



Orchard Establishment Approach

- Diagnostics Tests: Remediation after Corn/Soybean rotation to plant Apples
  - Organic Matter & Mineralization
  - Soil Food-web Structure & Composition
  - Carbon/Nitrogen budget analysis
  - Nematode Community Structure
- Ground Cover & Surrounding Habitat Management
  - Mulching
  - Legume green manure
  - Grass drive rows
  - Weed seed-bank management
  - Rootstock & Variety Selections

Start from the soil up: green manure planted in spring 1st year

- Pest Management: Strategies, Tactics and Tools ("Techniques")
  - Monitoring: direct (1x/wk) & Indirect (traps, pit falls, spore rods)
  - Population suppression, exclusion, resistant rootstock and sine varieties, Pheromone Disruption, Virus, Biological Control agents, augmentation from Ecological Diversity strips.
  - Pesticides treatment thresholds, best management practices

Organic Plot

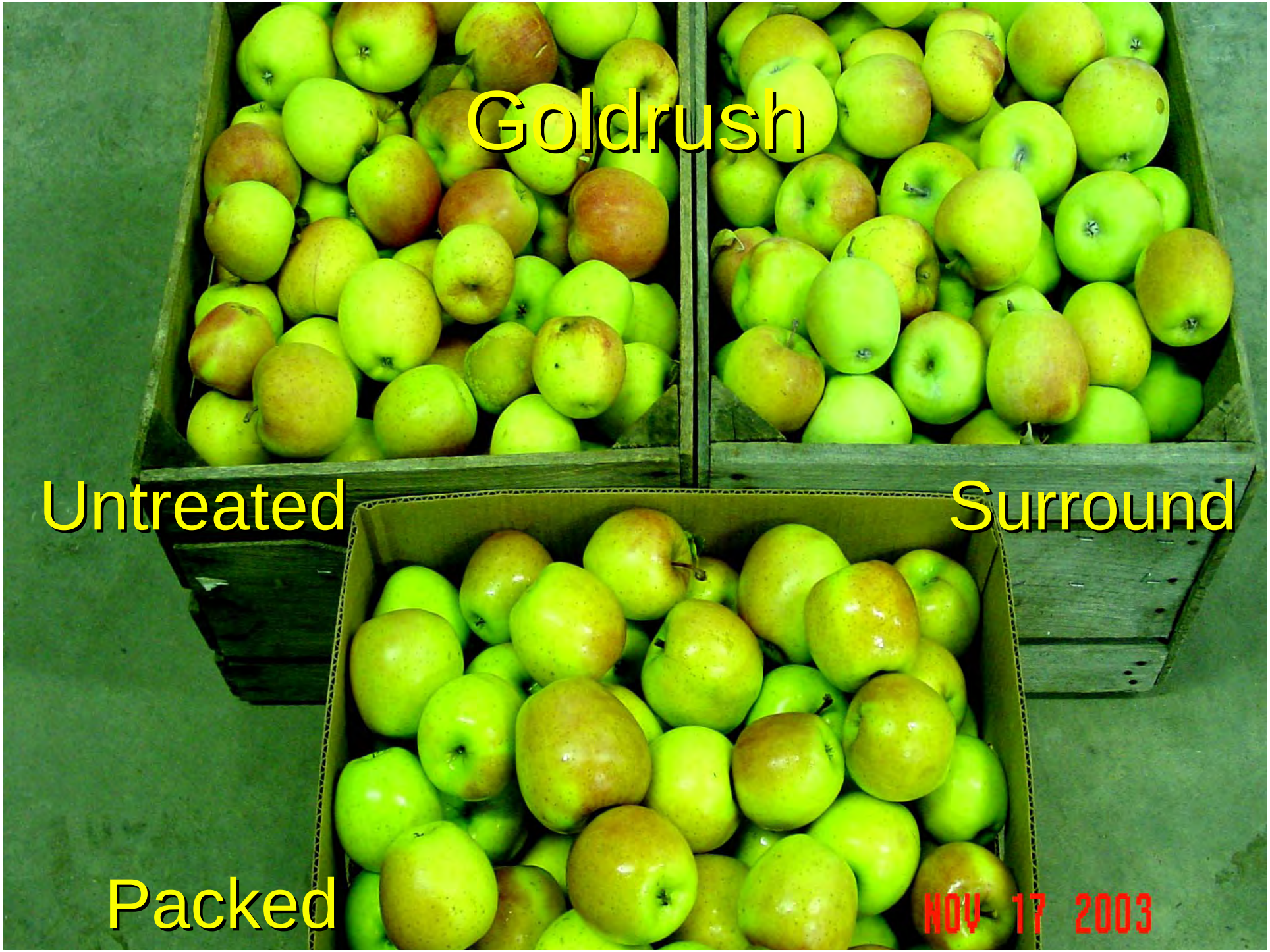

Organic Plot
AUG 8 2002

Organic Plot

Organic Plot


Organic Plot
Goldrush
SEP 29 2003


Gala
Surround
Packed
Untreated


Goldrush
Untreated
Surround
Packed
NOV 17 2003


Golden Delicious
Packed
Surround
Untreated

Pest Complex

Apple maggot

Plum Curculio

Fruitworms

Tarnished plant bug

Leafrollers

European red mite

Spotted Tentiform leafminor

Rosy apple aphids

Organic Functional Diversity Strategies

- **Cultural Control**
  - Living barrier
  - Ground cover
  - Sanitation
  - Mulching
  - Timed Mowing
  - Habitat Manipulations
- **Organic Ecology**
  - Soft pesticides
  - Attract and Kill
  - Trap out
  - Virus
- **Natural and Biological Control**
  - Generalist predators OK
  - Augmentative releases not necessary
  - Nectar reward helped parasitoids
- **Pheromone disruption**
- **Host Plant Resistance**
- **IPM Principles**
  - Monitoring
  - Timing
  - Thresholds

Alternative Orchard Designs

- **Manipulate micro-environment…high tunnel**
- **Barriers to human, odor, noise & chemical trespass…**
- **Wildlife control & reduced impacts…**
- **Barriers to insect and disease movement…SITE OF BIOPESTICIDE APPLICATION & SEMIOCHEMICAL RELEASE**

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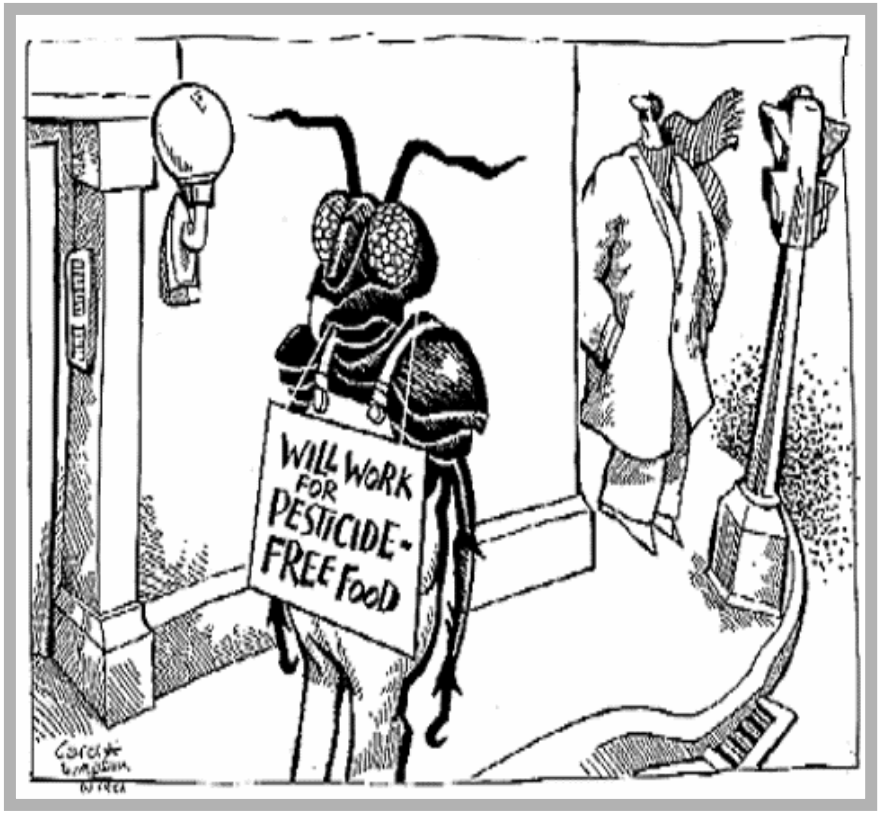
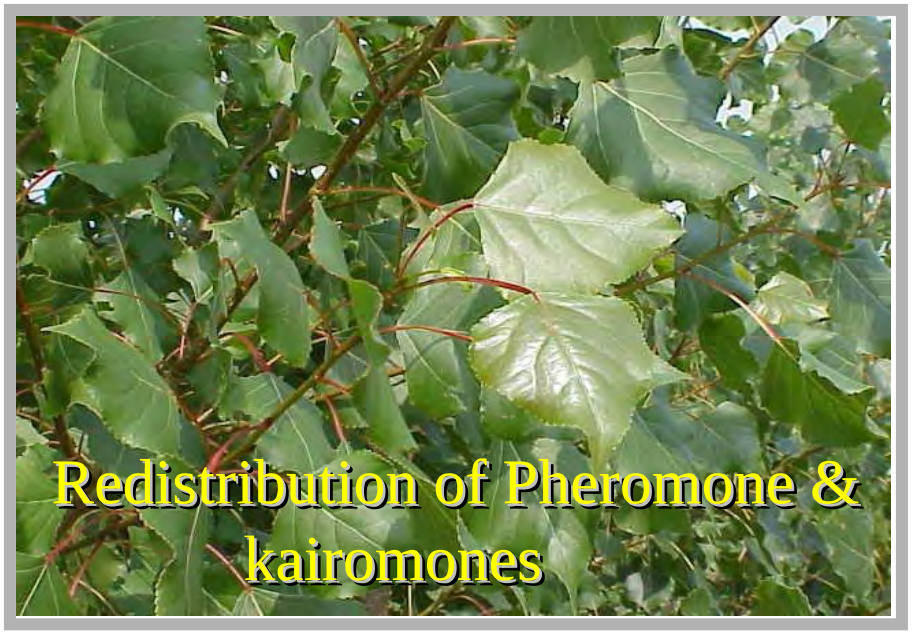
Extra Floral Nectaries + Waxy Cuticle

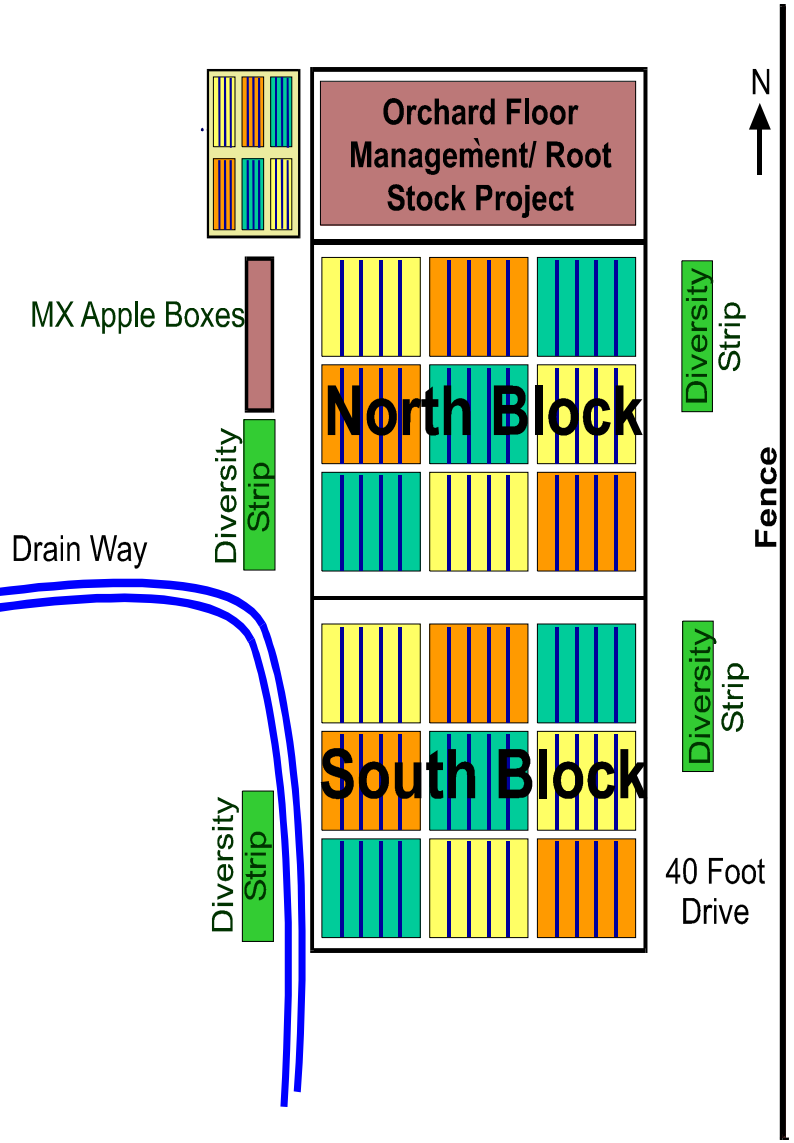
- **Feed the Good Guys**
- **Catch & Redistribute pheromone/kairomones**





Clarksville Organic Apple Project

- Soil, ground cover & tree
- Pathogen Control
- Organic IPM
  - Attract & Kill PC
  - Surround
  - Virus for CM
  - Predators for OBLR
  - Predators for Soft insects
- Diversity Strips = mesoarea
- Research
  - Beneficial Insect Monitoring Transects
  - Root stocks
  - Ground covers/mulches
  - Pest management
  - Soil management
- Open Access to Visitors
- Regional Educational Impact



Bio-Diversity Strips for IPM

Project Goal- **Use border plantings to provide food (pollen & nectar) and refuge for beneficial insects.**

Establish Strips

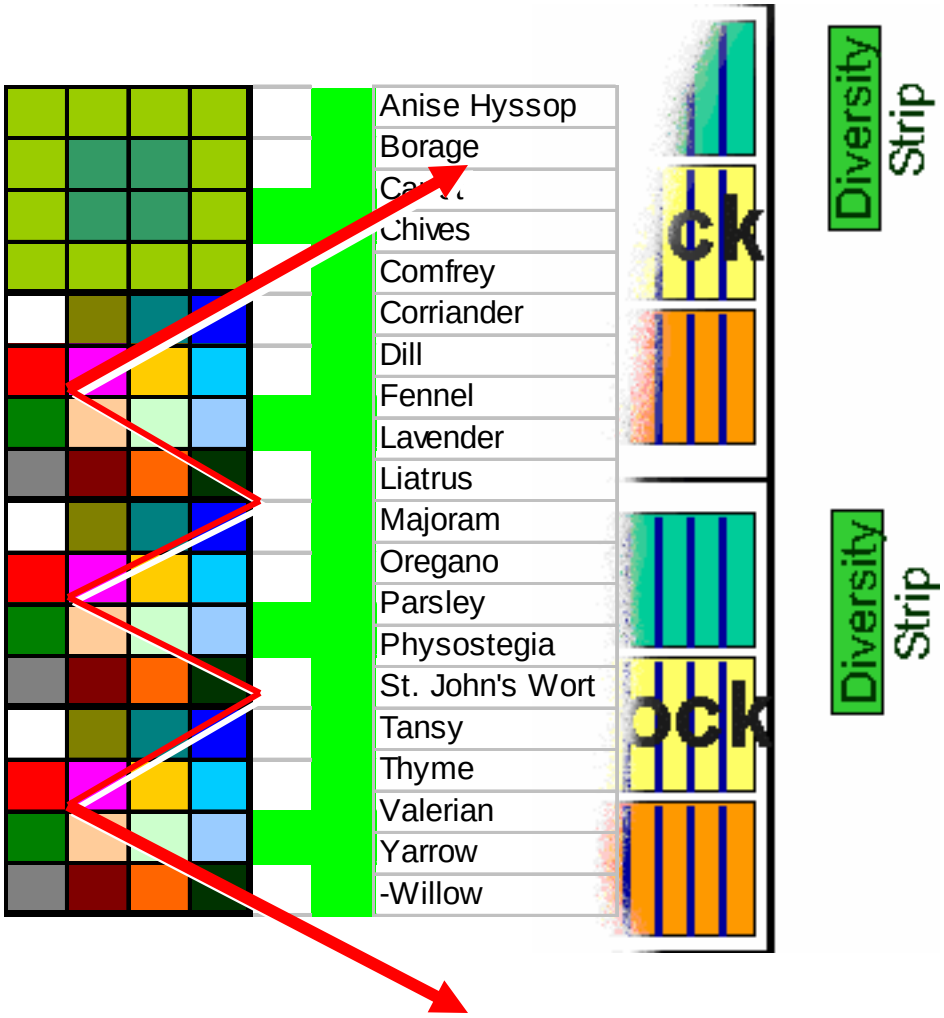
- **Native Plants that provide food throughout the season**
- **Irrigated & plastic mulch**

Neutral Strips (Control)

- **Neutral (?) = orchard grass**
- **Weed suppression & compaction**

Alternative Crops: multi-cropping

- **Herbs, flowers, potted plants**



Diversity Strip

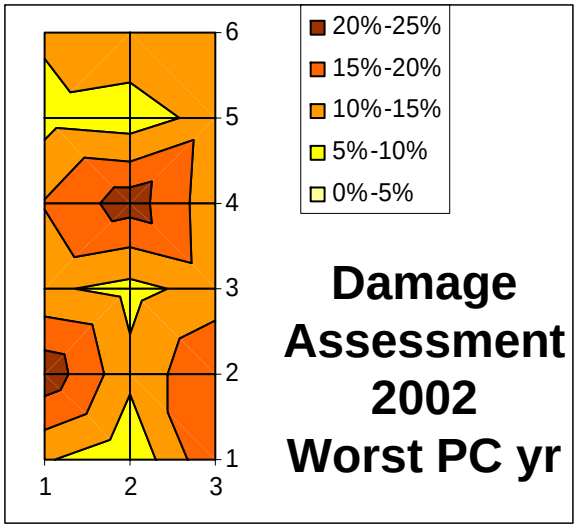
- Reservoir for beneficial insects
  - Predators and parasitoids Establish Durable Plants
- Provide Nectar, Pollen, and Refuge
- Established durable planting that requires low maintenance.

Fall 2005 Diversity Strip

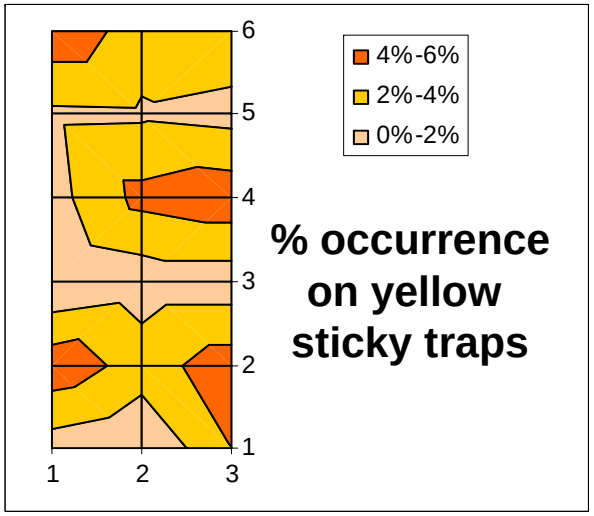
Some Plots are 6ft High and Dense
Flower and Nectar Reward Season Long
Picture = Late September

Damage or Trap Catch by location

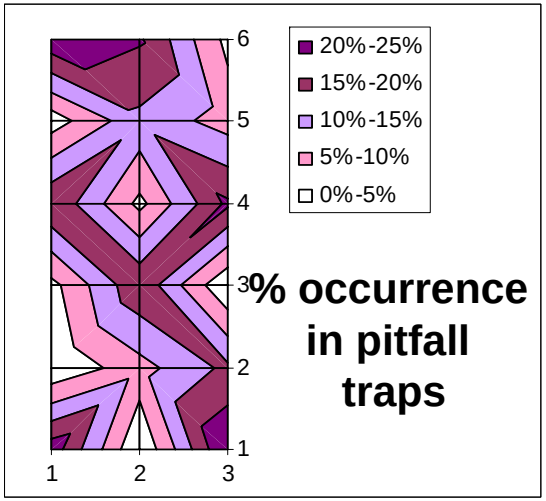
PC Damage



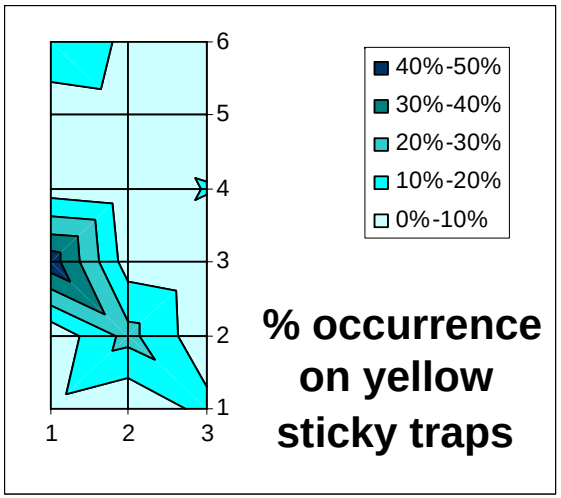
All Predators

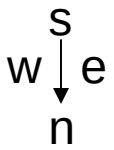


Ground Beetles



Syrphids



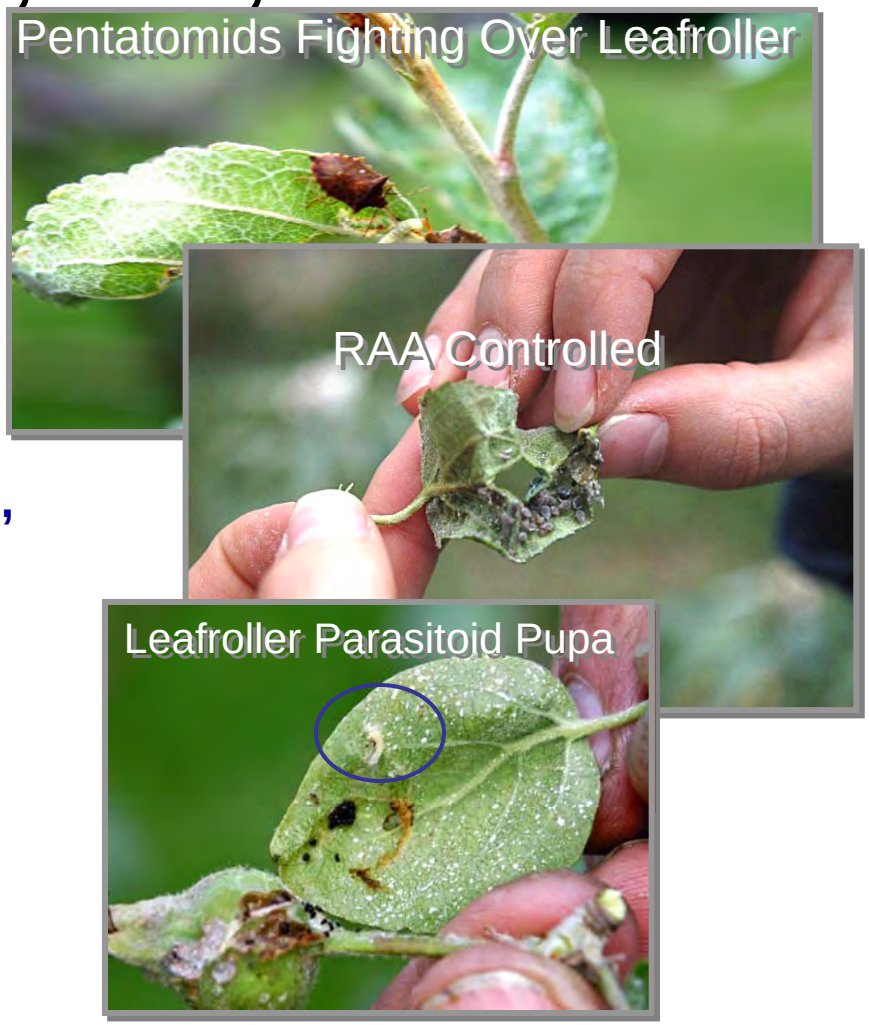


The top end of each figure is the south end of the plot

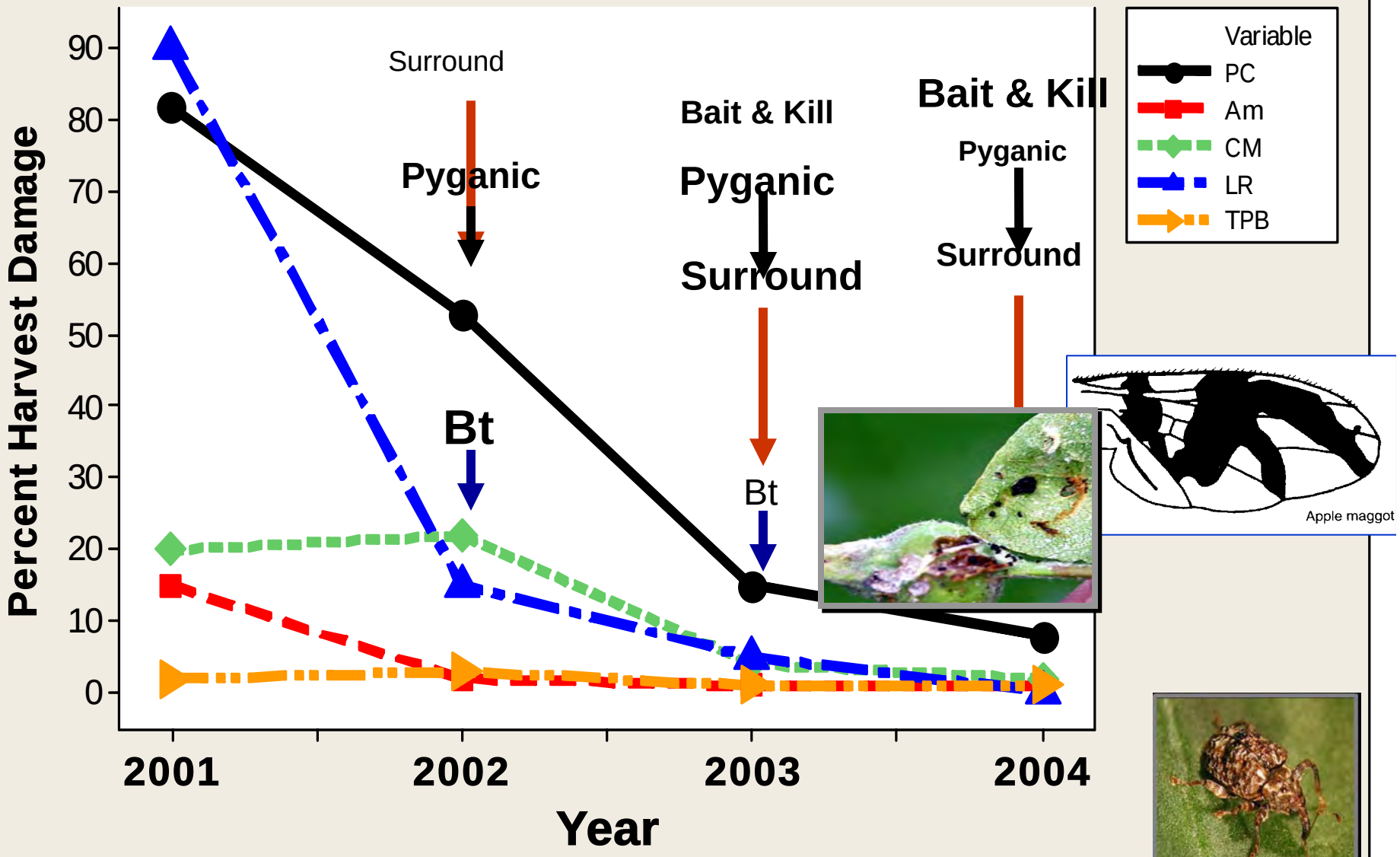
Data represent percent occurrence in traps

Biological Control: Rosie Apple Aphids, Tarnished Plant Bugs, Leafrollers, Budworms, Fruitworms, CM/OFM, Mites, …

- **Monitoring?**
- **Ratios for Thresholds?**
  - **Predators : Pest**
- **Establish Predators & Parasites w/in Orchard**
  - **Especially: Mites, Rosie Aphid, Mites & Leafrollers**
- **Works for many pest species--Except for PC**
- **Sulfur can induce Mite outbreaks**

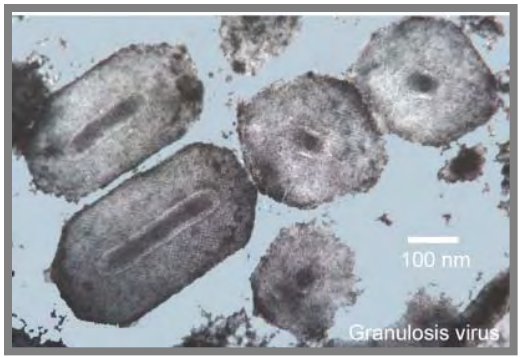


Curculio, Maggot, Codling, Leafroller, Plant Bug Damage



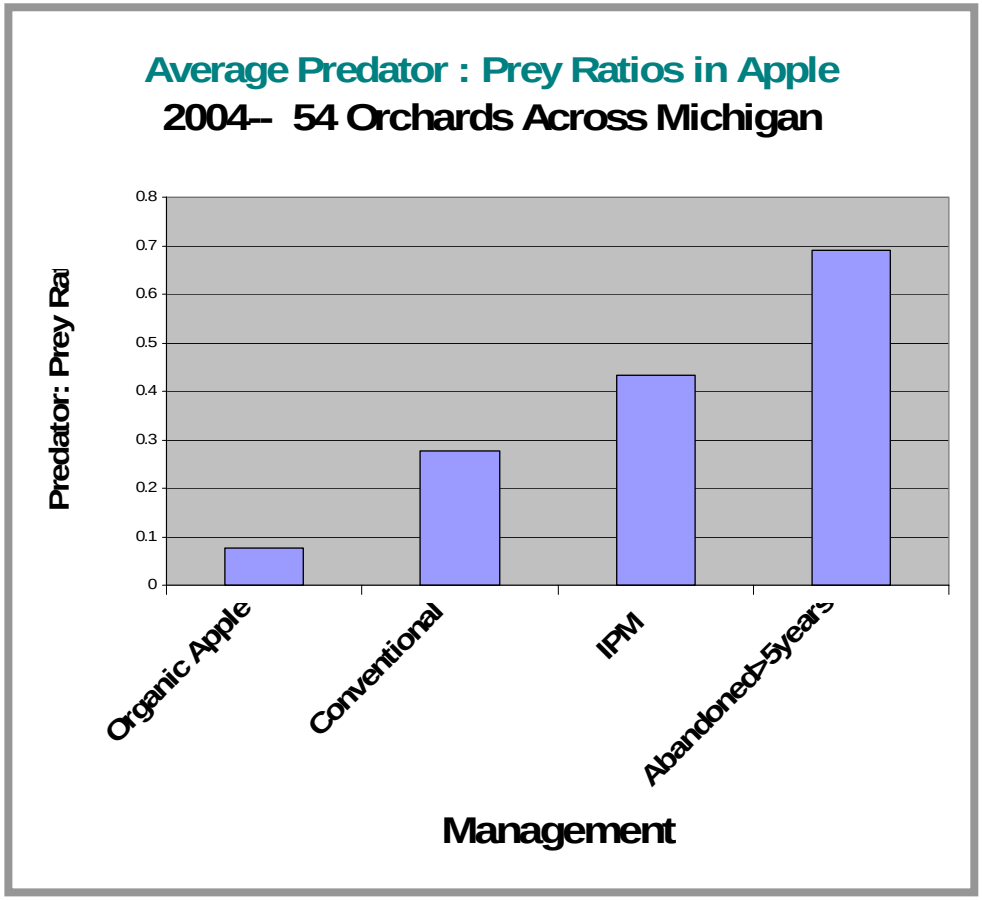
Granulosis Virus: Codling Moth

- **Key Issues**
  - **Cost**
  - **Timing**
    - **Spray Frequency & Rate**
  - **Integration with other Tactics and Tools**
    - **Understanding establishment & reinfestation**
    - **In Combination with Pheromones**

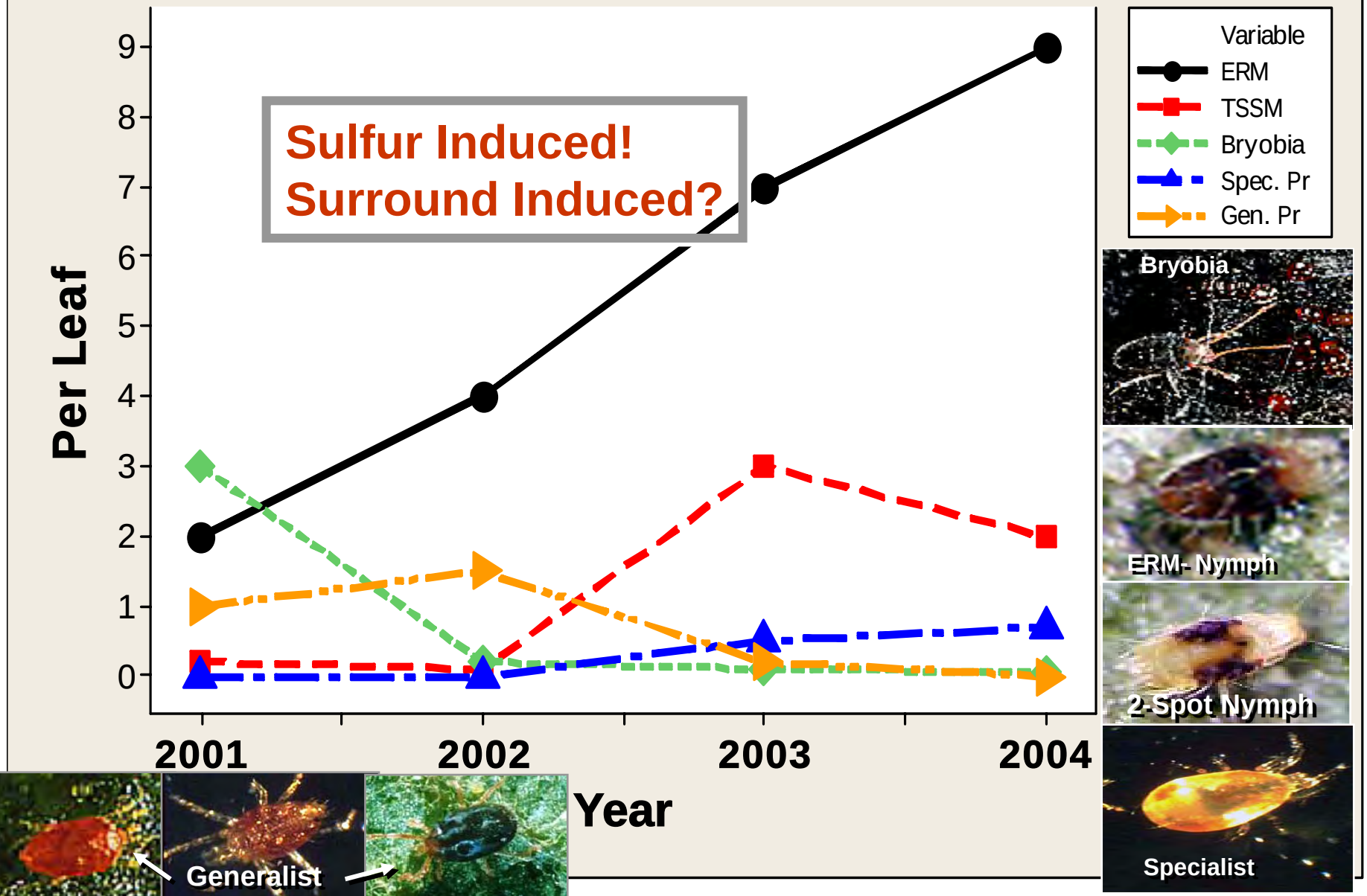


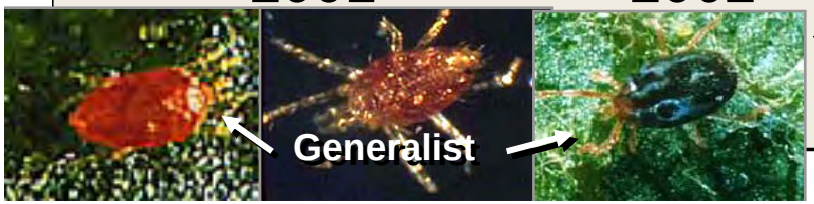
Mites Present a Growing Challenge for Organic Growers-

- **Sulfur Reduces Predators**
- **Oils Reduce Predators, but Timing may resolve impact**
- **Surround Irritates Predators & May reduce numbers**
- **PyGanic Reduces Predators but is very short-lived**



ER-Mite, 2-Spotted, Bryobia, Specialist & Generalist Predators



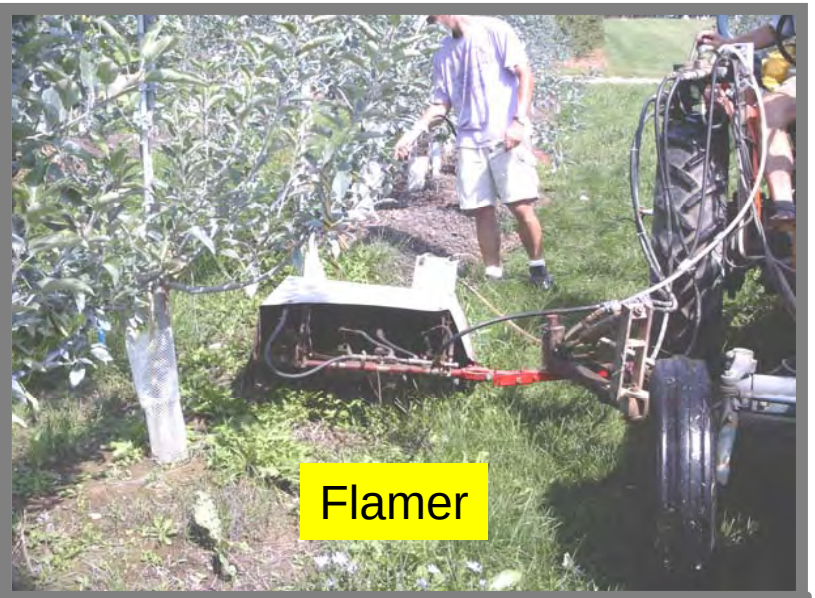


Fruit Fly Bait and Kill with Spinosad

- **Better Bait Formulation.**
- **Get low-volume application technology distributed.**
- **Adjust dosage to Adult fly densities to reduce costs.**

Ground Cover, Nutrients & Weed Control

- **Swiss Sandwich System**
- **Flaming for Weed Control**
- **Composting**
- **Legume Grass Drive Row = nutrients**



Biodiversity: Building Credits

Education: Growers & Technical folks Together

Bringing growers & other interested folks together in the field…