

# INTEGRATED PEST MANAGEMENT OF GREENHOUSE VEGETABLES IN CANADA

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## Canadian Greenhouse Industry

- Dynamic, highly technologically advanced industry



## Canadian Greenhouse Vegetable Industry Statistics

- Expanding at a rate of 10-20% per year
- Current greenhouse vegetable acreage is 887 ha
- Average greenhouse operation in Ontario is 2.5 ha
- Farmgate value in 2002 was \$0.75 billion Canadian
- United States is the largest market for greenhouse vegetables
- In Ontario and British Columbia, >70% of the tomatoes are exported to U.S.
- Tomatoes are the largest crop

## Double Polyethylene is the Predominant Greenhouse Structure



## IPM of Greenhouse Vegetables in Canada

- IPM in Canada is an integrated crop management (ICM) approach.
- ICM includes production practices, climate management, sanitation, crop clean-up, and pest and disease control measures.

## Development of an IPM Program

### Major Components

- ✓ Pest monitoring
- ✓ Action thresholds
- ✓ Management strategies

# Pest Monitoring Program

## Tools

- Sticky cards
  - Yellow and blue



- Plant inspection



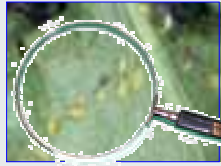
# Sticky Cards

- Yellow is more attractive to the majority of pest species. Blue is specific to thrips.
- Place cards in the crop as soon as it is planted.
- Hang cards vertically so bottom of card is just above crop canopy.
- Use approximately 1 card per 100 m<sup>2</sup> in small areas and 1 card per 400 m<sup>2</sup> in large areas.
- Important to count pest densities on a weekly basis.
- Either replace cards weekly, when there are too many pests to count accurately or when the cards are no longer sticky.
- Place extra cards near walls or entrances to detect early infestations.



# Plant Inspection

Estimate pest densities



Aphids on tomato



Two spotted spider mites

Detect pest damage symptoms



Lygus damage



TSSM damage

# Record-Keeping for Pest Monitoring

## Record Sheet

**Average number of pests/week**

Section: \_\_\_\_\_

Crop: \_\_\_\_\_

Date	Whiteflies	Thrips	Aphids	Notes



# Record-Keeping for Pest Monitoring

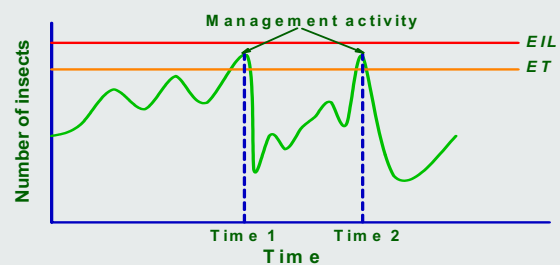
## Map of Greenhouse Crop

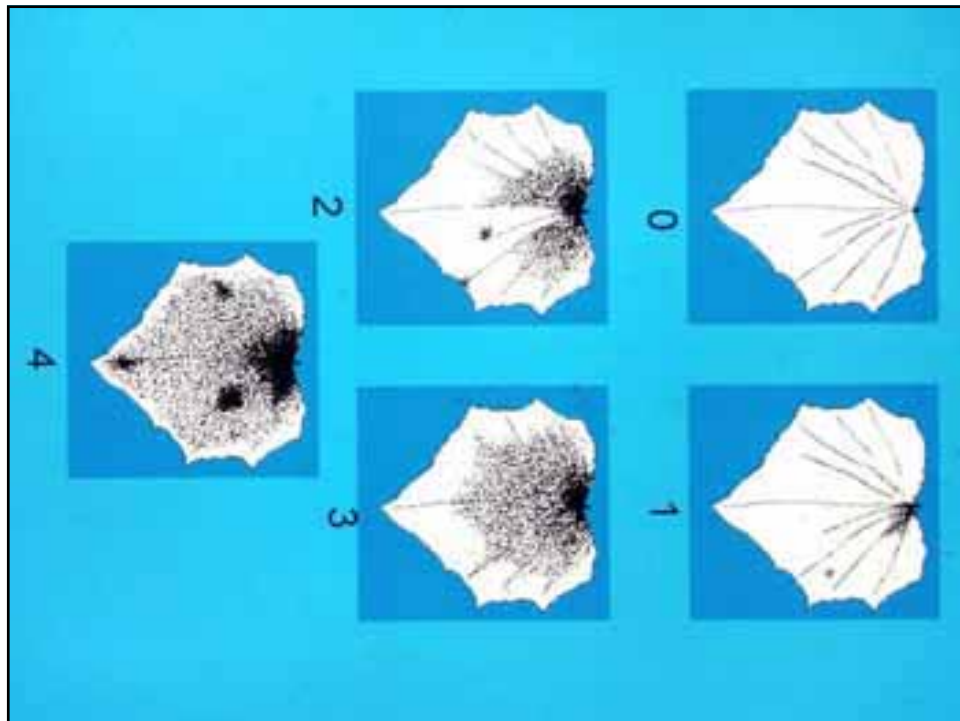
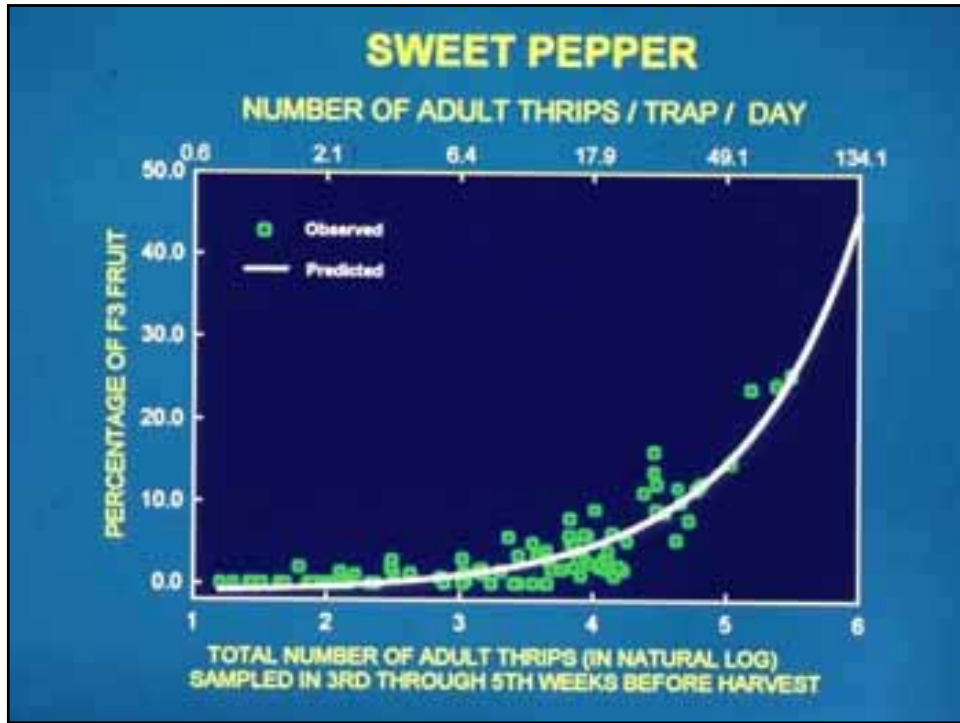


# Action Threshold

**EIL:** *Lowest pest population density that will cause economic damage.*

**ET:** *Population density at which a control action should be implemented to prevent an increasing pest population (injury) from reaching the EIL.*





## TWO SPOTTED SPIDER MITE

### Cucumber:

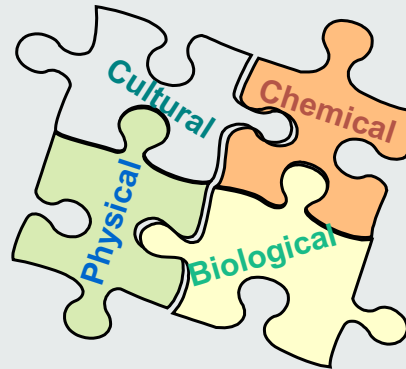
- economic damage occurs at a rating of 1.9 which is equivalent to 30% reduction of photosynthetic area of the leaf
- rating of 2.5 will result in 40% loss in yield after 5 wk

### Tomato:

- economic damage starts at similar rating of 2.0

## Control Strategies

- Chemical
- Cultural
- Physical
- Biological





## Chemical Control

### Advantages

- Provides effective control in short time period (often 24-48 h)
- Less expensive
- Different modes of action (ie., feeding deterrent, insect growth regulator, contact poison or systemic action)
- Can be short residual time and host specific

### Disadvantages

- Insecticide resistance
- Can be broad spectrum for target hosts
- Long residual time
- Human and environmental health concerns

## Chemical Families

Family Name	Active Ingredient	Trade Name
Organochlorine	endosulfan	Thiodan
Organophosphate	dichlorvos	DDVP
Carbamate	methomyl	Lannate
Synthetic Pyrethroid	permethrin	Ambush
Insect Growth Regulator	buprofezin	Applaud
Neonicotinoid	imidaclopid	Admire
Naturalyte	spinosad	Conserve

# Cultural Control

## Sanitation

- Starts with clean-up of the previous crop
- Fumigate crop if pests present
- Disinfect growing media, fertigation equipment and greenhouse structure
- Remove all crop residue and dispose properly
- Remove all weeds inside and around outside of greenhouse
- When greenhouse is empty, close vents and maintain temperature  $>40^{\circ}\text{C}$  for 2-3 days

## Use of High Temperature and Low Humidity for Pest Control at Crop Clean-up

