

Integrated Pest Management IPM

Pest Anticipation Fosters Responsible Reaction

IPM Short Study

Master Gardener Training

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Educating People to Help Themselves

Local Governments • U.S. Department of Agriculture

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Introduction

Increased Public Scrutiny of IPM

- ◆ **IPM is Merely Pesticide Justification**
- ◆ **Producers are Pesticide “Trigger Happy”**
- ◆ **1996 Food Quality Protection Act, FQPA**

IPM – The Philosophy

- ◆ **Pest Management Not Pesticide Management**
- ◆ **National IPM Program -- CES Guidelines mandate a 75% IPM implemented program by the year 2000**
- ◆ **Enhance the Primary Pest Control Management Tactics: Host Plant Resistance, Biological Control, and Habitat Alteration**
- ◆ **Reduce to Prescriptive Use of Pesticides – The Secondary Pest Control Tactic**

Integrated Pest Management -- IPM Pest Anticipation Fosters Responsible Reaction

What is IPM?

IPM defined by the National Integrated Pest Management Program Plan for the Cooperative Extension Service (CES):

“ Integrated pest management (IPM) is a sustainable approach which combines the use of biological, cultural, physical, and chemical tactics in a way that minimizes economic, health, and environmental risks.”

What is a Pest?

“ A pest is any organism which reduces the value, availability, or quality of a resource that humans regard as important. Generally 2% or less of all species present in a given agro-ecosystem are considered pests.”

Pests of Economic Importance: *Lamp 1991*

Classification # of Species

Vertebrates -----15

Insects/Arthropods -----10,000

Weeds-----1,800

Fungi-----8,000

Bacteria-----170

Viruses-----250

Nematodes-----500

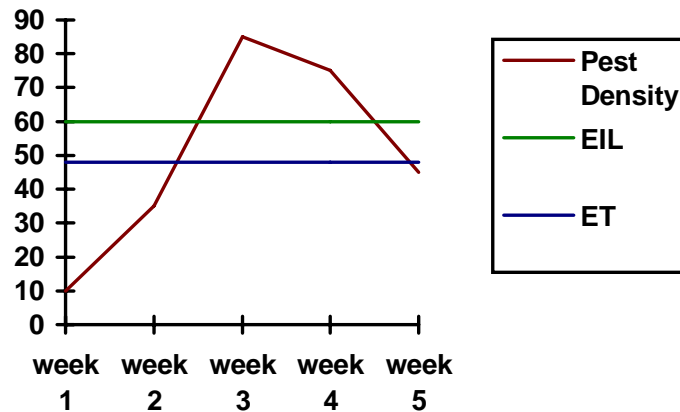
- ◆ **10% of Pests Cause Significant Damage**
- ◆ **2% of Pests Reach Economic Damage Levels**

Species Classification: Luckmann and Metcalf 1982

<u>Species Type</u>	<u>Species Density</u>	<u>Management Strategy</u>
Key Pest	Generally > EIL	Prevent/Respond
Occasional Pest	Generally < EIL	Respond
Potential Pest	Normally < EIL	Prevent
Migrant Pest	Normally < EIL	Respond
Non-Pest	Always < EIL	Protect
Beneficial	Always < EIL	Protect/Promote

- ◆ **Scouting** -- Monitoring & Predicting a Pests Population Density
- ◆ **Monitoring** -- A Sample Must Accurately Represent the Pest Population
- ◆ **Sample** – A Random Statistical Measurement where 90% of the Sample Mean is Within 25% of the True Mean

[Economic Injury Level -- EIL *Pedigo 1989*](#)



Economic Injury Level -- EIL :

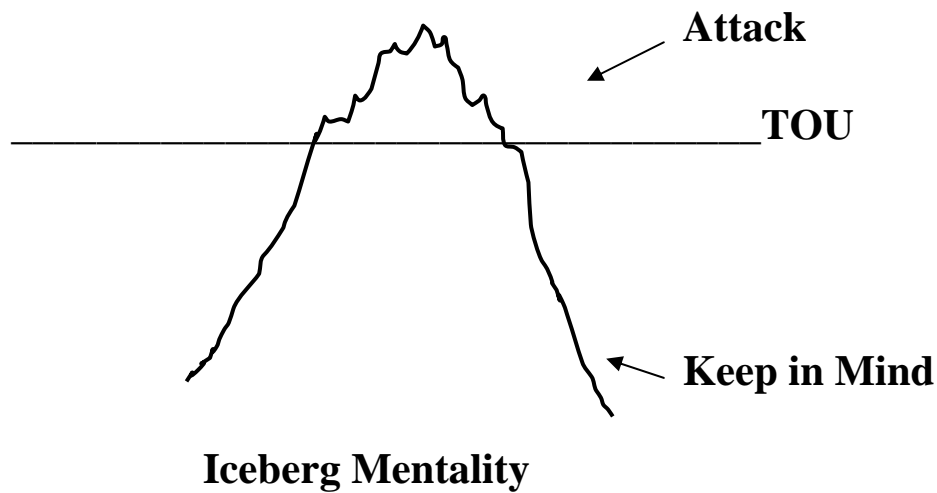
“The lowest pest population density that will cause economic damage. At the EIL -- Cost of Control = Benefit of Control.”

Economic Threshold (Action or Treatment Threshold) - ET:

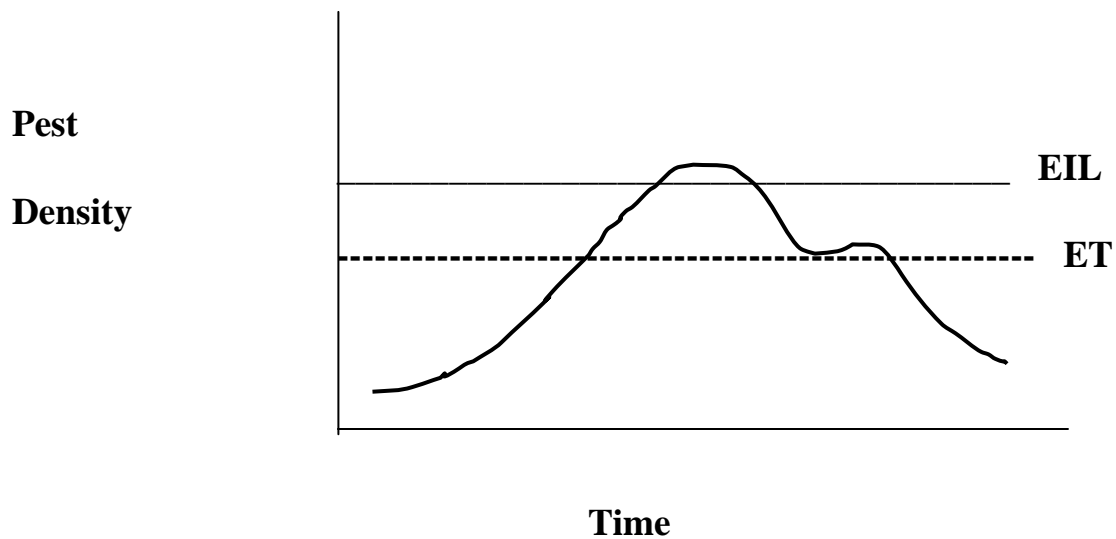
“The density of a pest at which control measures should be implemented to prevent an increasing pest population from reaching the EIL -- ET is generally 80% of the EIL.”

TOU Verses EIL

◆ **Threshold of Unacceptability (TOU) – A Personal Pest Density Approach**

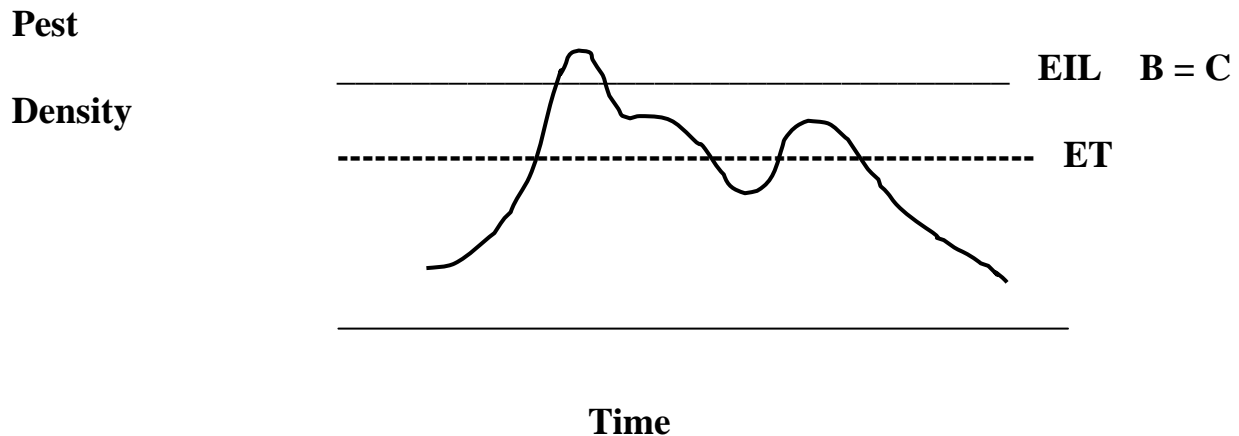


◆ **Economic Injury Level (EIL) – An Economic Pest Density Approach**



IPM Mechanics





EIL = Pest Density (P)

$$P = \frac{C}{V \times D}$$

C = Cost of Control

V = Value of Crop

D = Damage/Pest

Note: At EIL Benefit = Cost; B = C

Example: Potato Leaf Hopper (PLH) Injury to Potted Azaleas

Where:

C = \$ 1.00/ Pot

V = \$10.00/Pot

D = \$.10/PLH/Sweep

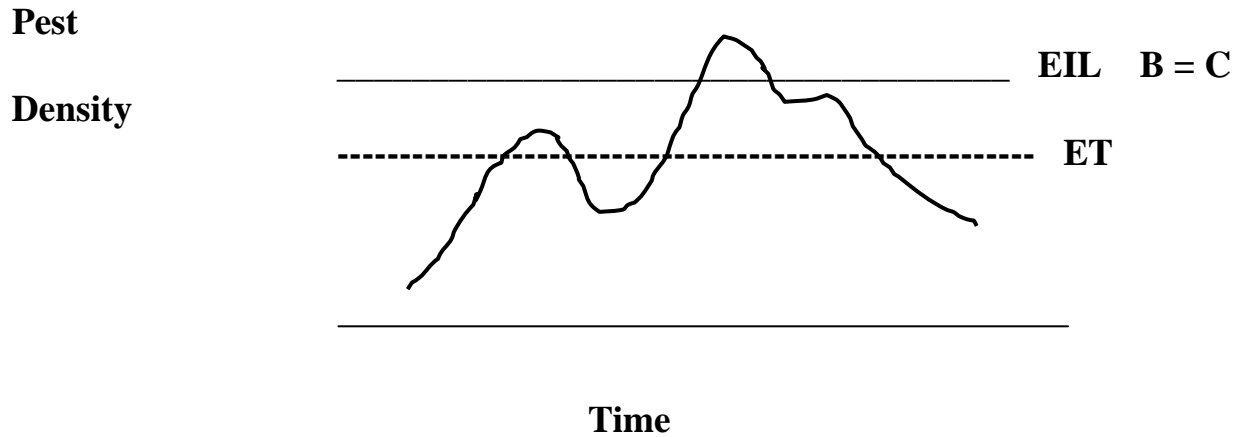
$$\text{EIL (P)} = \frac{\$1.00/\text{Pot}}{(\$10.00/\text{Pot}) \times (\$.10/\text{PLH}/\text{Sweep})}$$

$$\text{EIL} = 1 \text{ PLH}/\text{Sweep}$$

$$\text{ET} = .8 \text{ PLH}/\text{Sweep}$$

IPM Component Relationships





EIL = Pest Density (P)

$$P = \frac{C}{V \times D}$$

C = Cost of Control
V = Value of Crop
D = Damage/Pest

When C ↑ P ↑ and When C ↓ P ↓

When V ↑ P ↓ and When V ↓ P ↑

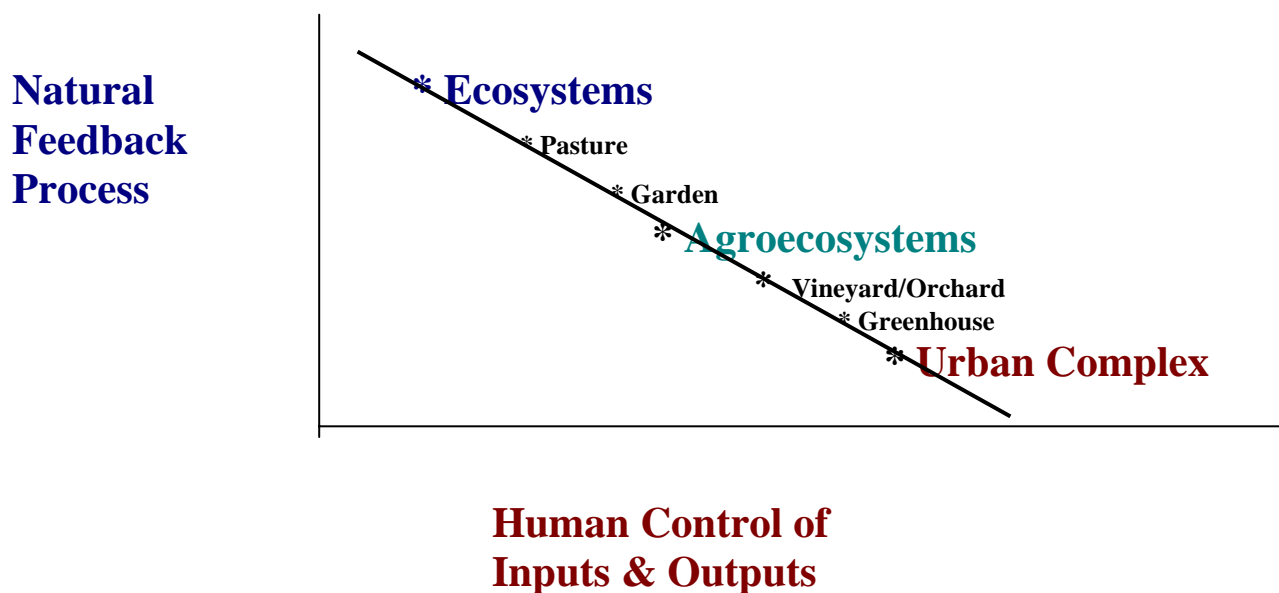
When D ↑ P ↓ and When D ↓ P ↑

IPM In Agroecosystems

Ecosystems – Interaction of organisms in Their Physical Environment

Agroecosystems – Man Managed Ecosystem – Ecosystem Constraints

Why are Pests in Gardens Less Likely Than in Field Crops to Reach Damaging Pest levels?



Pest Population Constraints

Spider Mite population Model

Parameters: 2 week Life Cycle, 50 Offspring/ Female, Ideal Conditions

<u>Generation</u>	<u>Time</u>	<u>Population</u>
0	0	1
1	2	25
2	4	625
3	6	15,625
4	8	390,625
5	9	9,765,625
↓	↓	↓
26	52	2.2 X 10 ³⁶

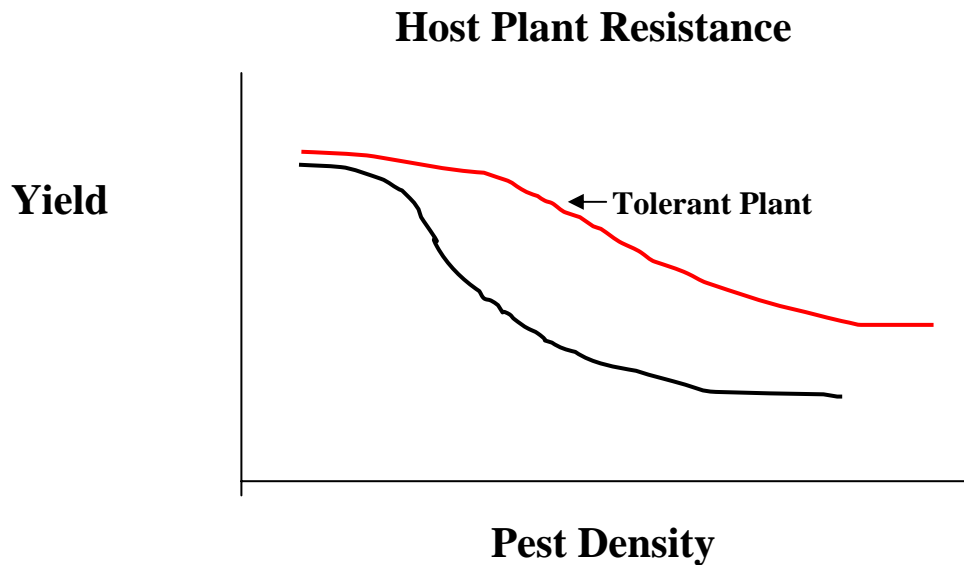
**A Ball of Mites the
Size of Earth**

$$\text{Population } \in = \mathbf{B}_{\text{Birthrate}} - \mathbf{D}_{\text{Deathrate}} + \mathbf{I}_{\text{Immigration}} - \mathbf{E}_{\text{Emmigration}}$$

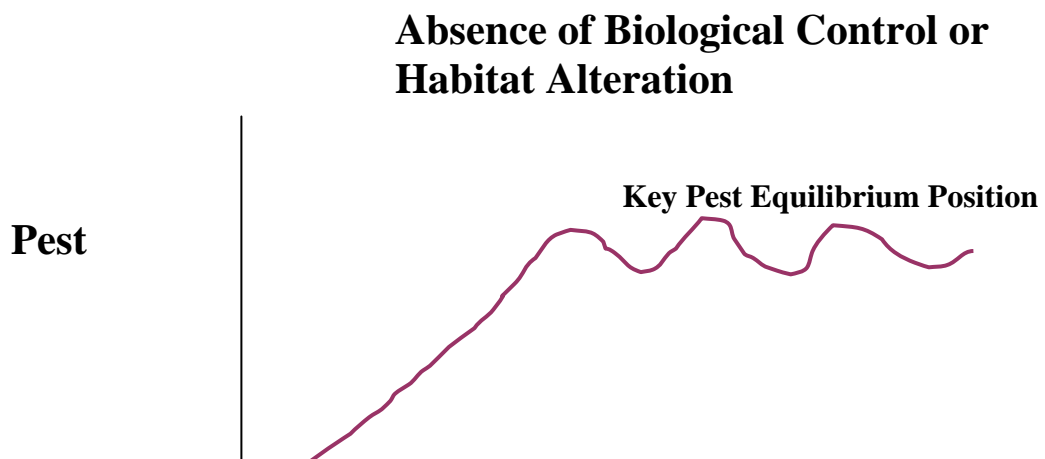
Primary IPM Management Control Tactics

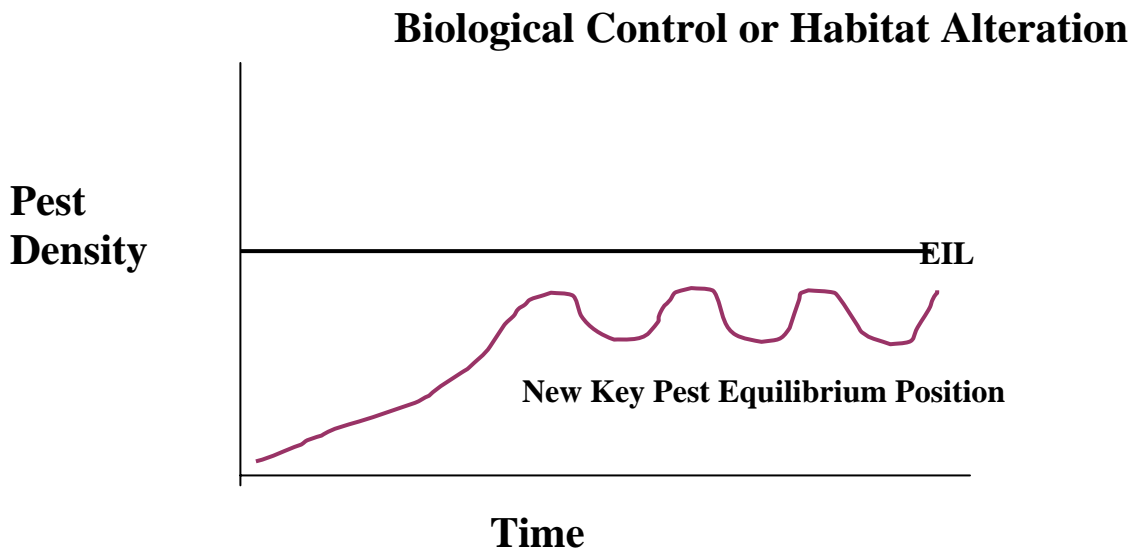
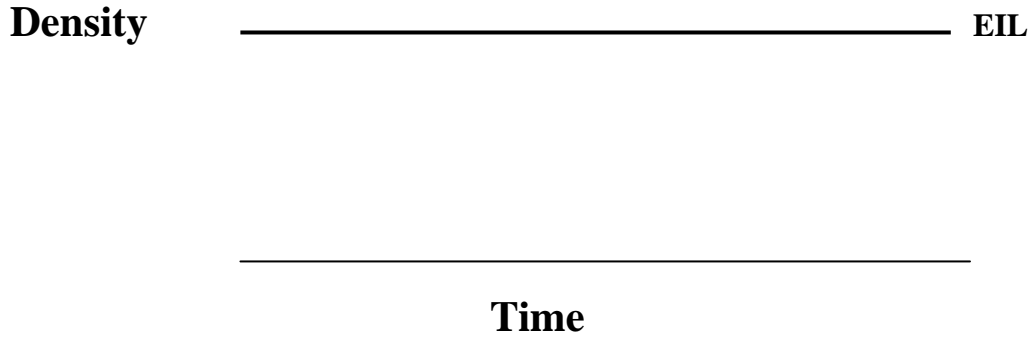
- ◆ **Host Plant Resistance – Breeding Selection**
- ◆ **Biological Control – Natural Enemies**

◆ **Habitat Alteration – Cultural Practices**



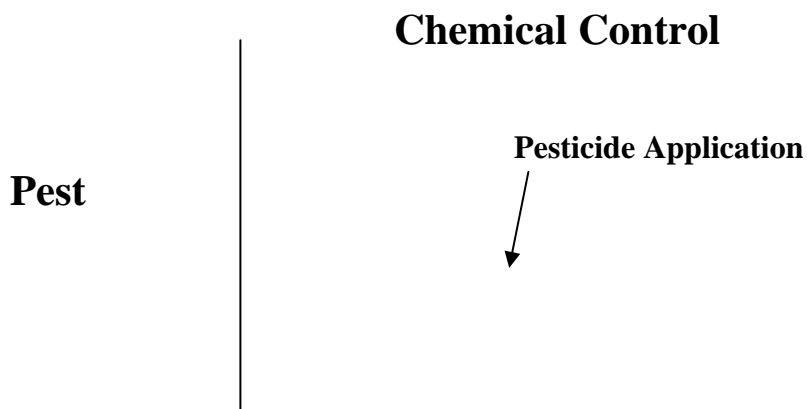
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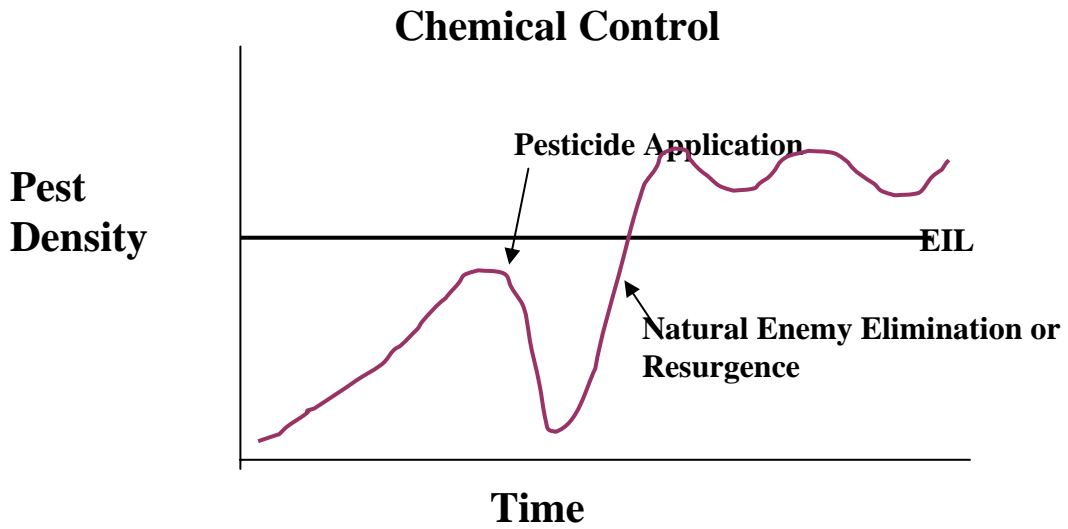
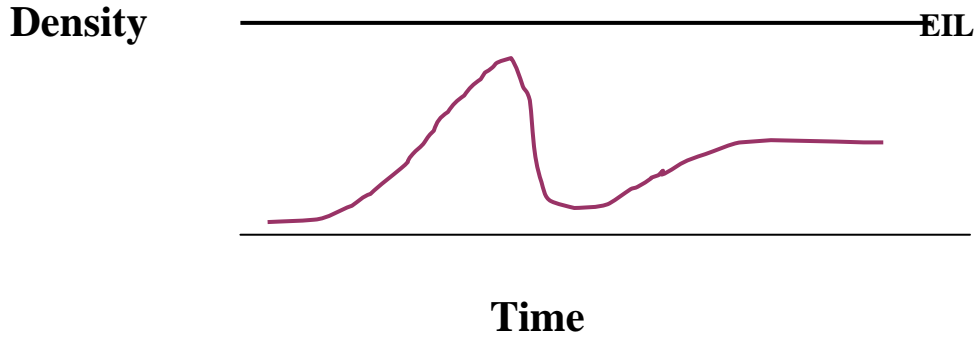




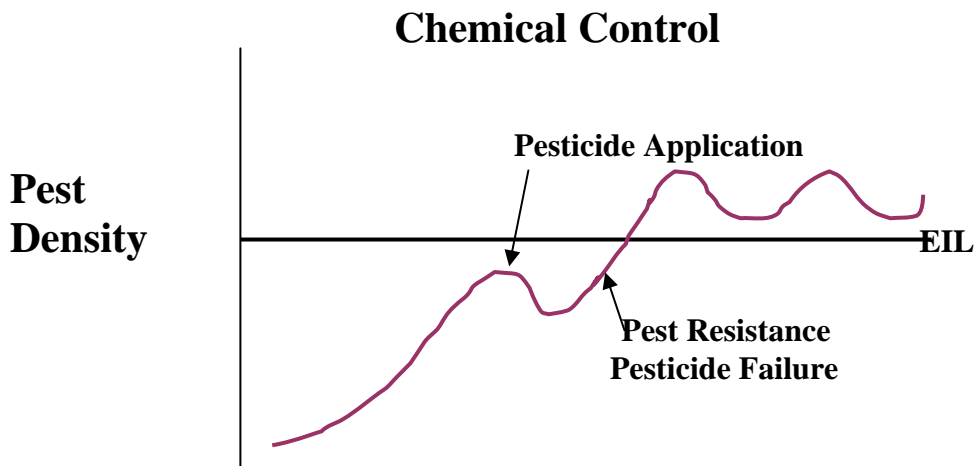
Secondary IPM Management Control Tactics

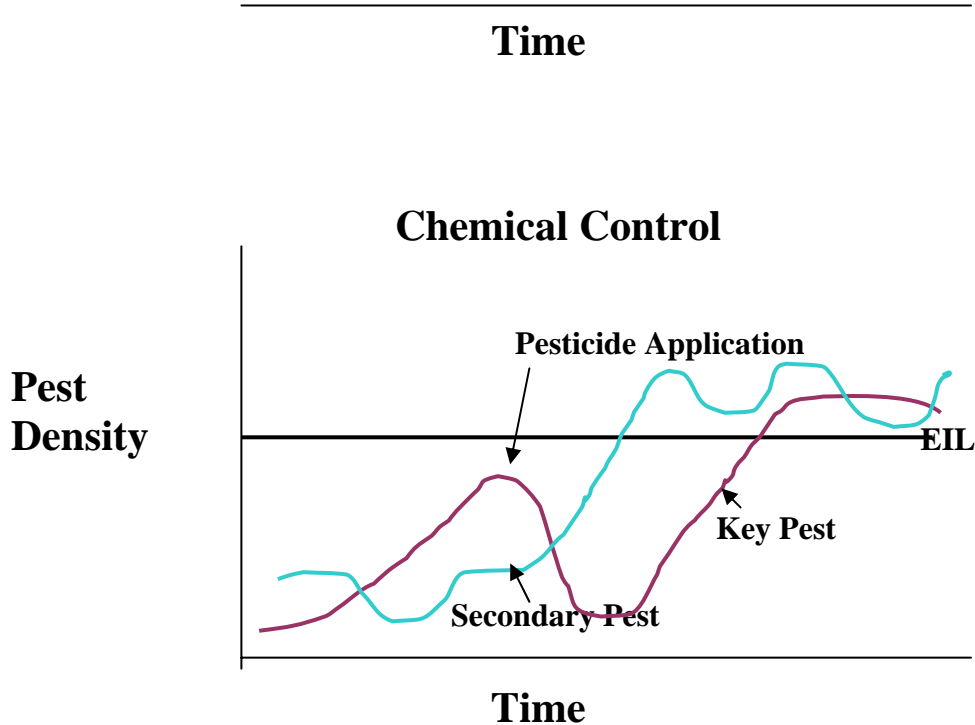
- ◆ Prescriptive Use of Pesticides – Temporary Control Tactic





Secondary IPM Management Control Tactics





Unexpected Pesticide Results

1. Natural Enemy Elimination
2. Resurgence
3. Pest Resistance
4. Pesticide failure
5. Secondary Pest Outbreak

Pest Control Tactics

I. Host Plant Resistance

A. Plant Breeding

1. Select for Fireblight Resistant Apple Varieties
2. Pubescence

B. Transgenic Plants

1. Bt Sweet Corn

2. Round-Up Ready Soybeans

II. Biological Control

A. Parasite/Predator Release

- 1. Parasitic Wasps released for Alfalfa Weevil Control**
- 2. Beetle Release for Thistle Control**

B. Augmentation of Natural Enemies

- 1. Conservation by Selection and Timing of Control**
- 2. Poly-Culture -- Field Boarder Reservoir**

III. Habitat Alteration

A. Cultural Production Practices

- 1. Tillage**
- 2. Sanitation -- Orchard Sweeping**

B. BMP's -- Cover Crops, Nutrient Management, Crop Rotations, etc..

- 1. Diversification of Species**
- 2. Prediction -- Pest Anticipation**

IV. Chemical Control

A. Eradicant

- 1. Selective Pesticides -- Poast for Grasses in Strawberries**
- 2. Prescriptive Pesticides -- Bayleton for Powdery Mildew on Pumpkins**

B. Protectant

- 1. Broad Spectrum -- Ridomil for Soil Borne Fungi**
- 2. Preventative -- Dormant Oils**

Pesticide Usage Directives 1992

National IPM Program -- CES Guidelines mandate a 75% IPM implemented program by the year 2000.

The Department of Defense -- DOD mandates a 50% reduction of In-House pesticide usage prior to the year 2000.

Pest Anticipation Fosters a Responsible Reaction:

- > Understanding a Pests Activity Period, Life Cycle and the Effect of GDU's**
- Agroecosystem and Environmental Factors which Alter EIL and ET.**
- > Cessation of Pest Population Spikes via Crop Diversification and BMP's.**
- > Production Practice and Pest Tactic Changes often Bring Unexpected Results.**
- Strive to Replace Insurance Pesticide Application with a Prescriptive Approach.**