Integrated Pest Management (IPM) for Organic Agriculture

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What is a pest?

- ***organisms that damage or interfere with our activities***
- ***impact human or animal health***
- ***transmit disease or may be just a nuisance***

What is Integrated Pest Management?

IPM is a sustainable approach to managing pests by **combining the use of all practical methods of pest control**

- Cultural, physical, biological, and chemical methods
- Attain the producer's goals while **minimizing economic, health, and environmental risks**

IPM is based on the science of ecology

- Population dynamics (predator/prey)
- Food webs
- Phenology (relations between climate and periodic biological phenomena)

Everything is connected

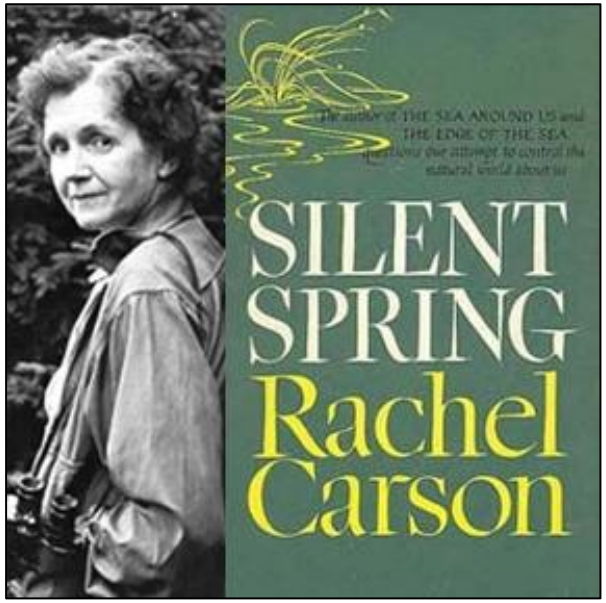
Why IPM?

Era of traditional approaches (ancient-1938)

Era of pesticides (1939-1962)

Era of integrated pest management (1963-recent)

New approaches?



What is the "Pesticide Treadmill"?

Pesticide resistance

Pest rebound

Secondary pest outbreaks

This is important for organic pesticides as well

Image source: commondreams.org

Pesticide Resistance

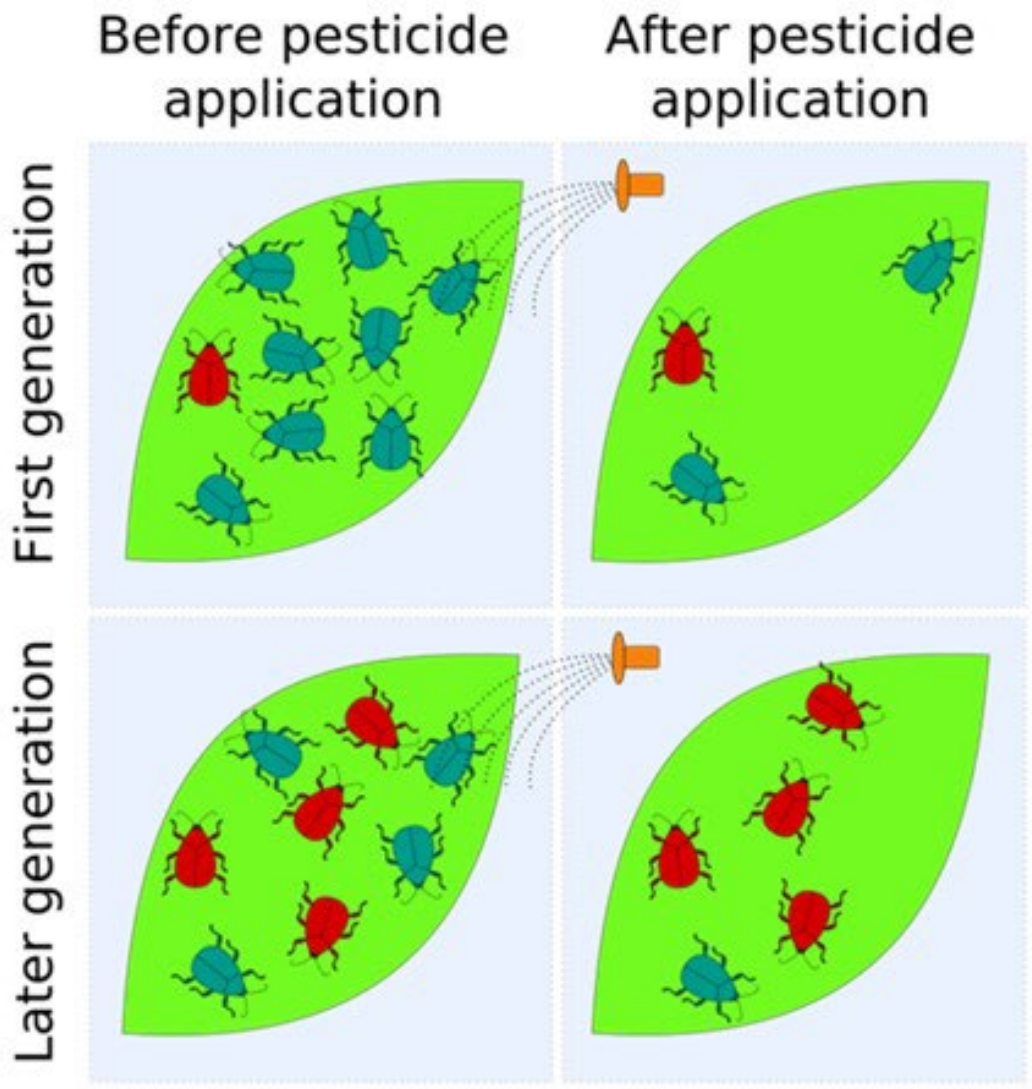
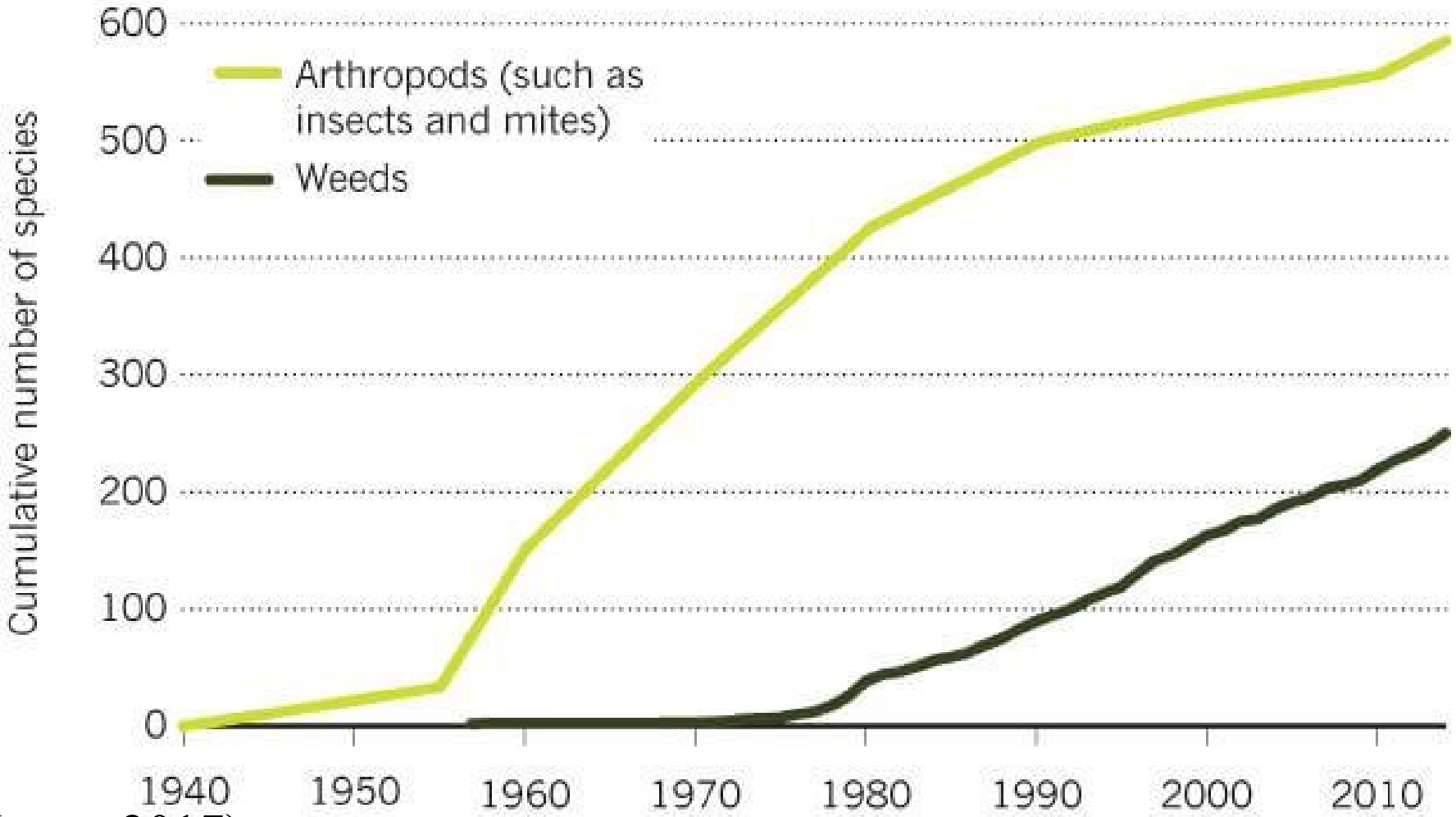


Image source: GFDL

Pesticide use increases natural selection pressure for resistance

THE RISE OF RESISTANCE

The number of pests (including insect and plant species) resistant to at least one form of synthetic pesticide has been steadily on the rise for decades, as has the cost of developing such chemicals.



(Nature 2017)

Secondary Pests

1/3 of the most damaging insects in the US were originally secondary pests and only became major problems after the use of pesticides

codling moth

pear psylla

spider mites

use of broad-spectrum insecticides for codling moth control exacerbates pear psylla…
broad-spectrum insecticides applied for pear psylla exacerbates mite infestations...

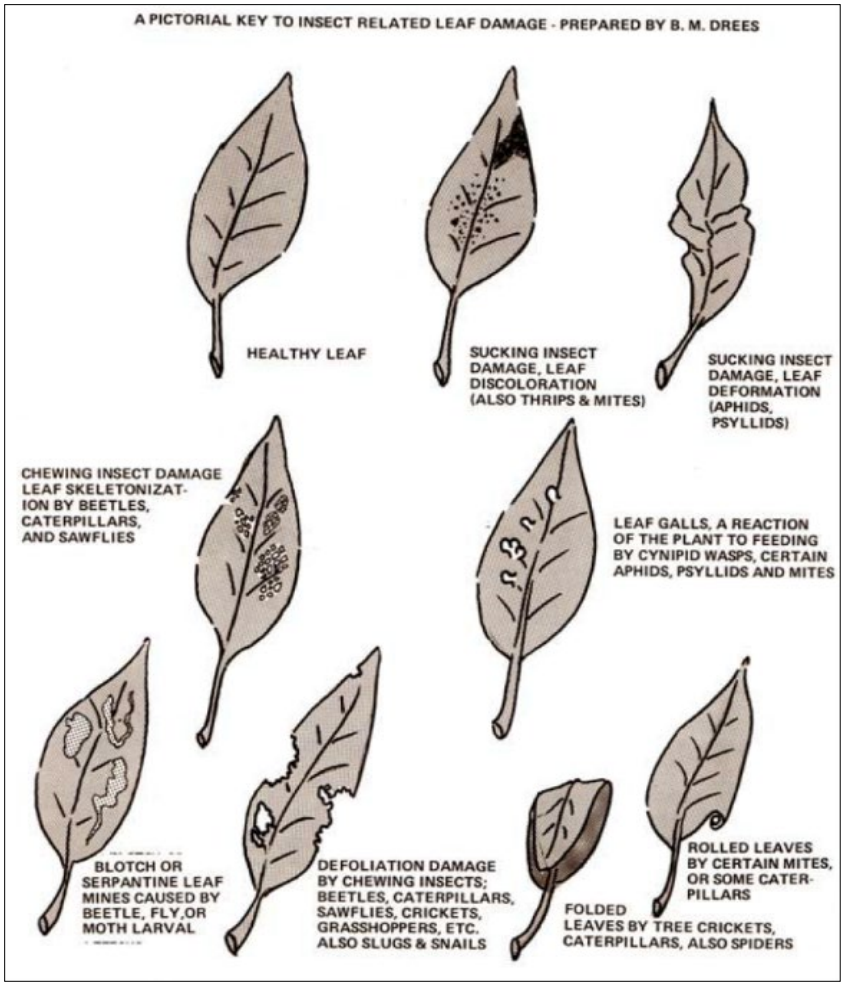
Key Steps in IPM

1. Correctly identify crop damage & responsible pest / cause

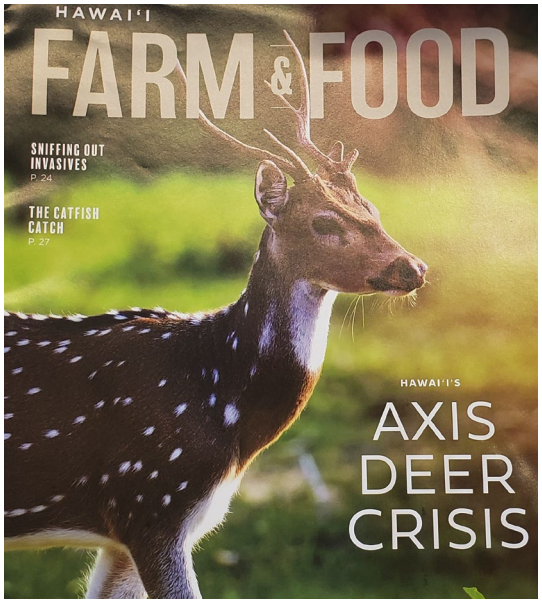
Be a good detective!!

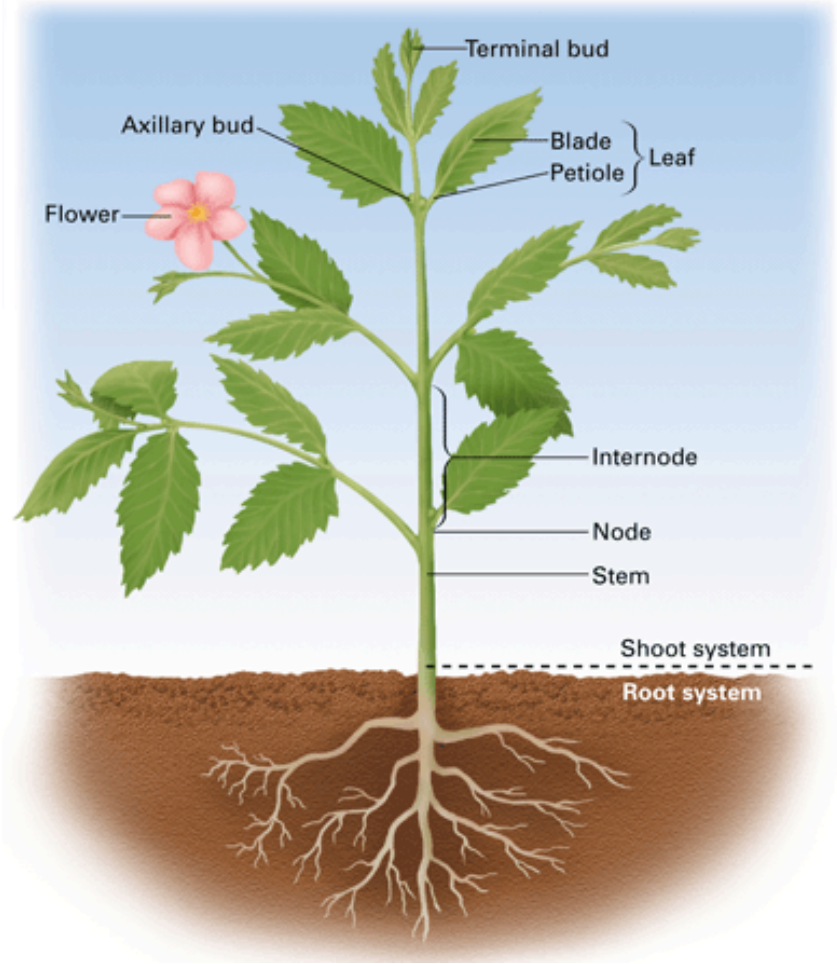
Learn to *recognize* types of damage and feeding, disease, nutrient deficiency *patterns*

The damage is often easier to detect that the pest / cause.



Integrated Pest Management should include ALL pests





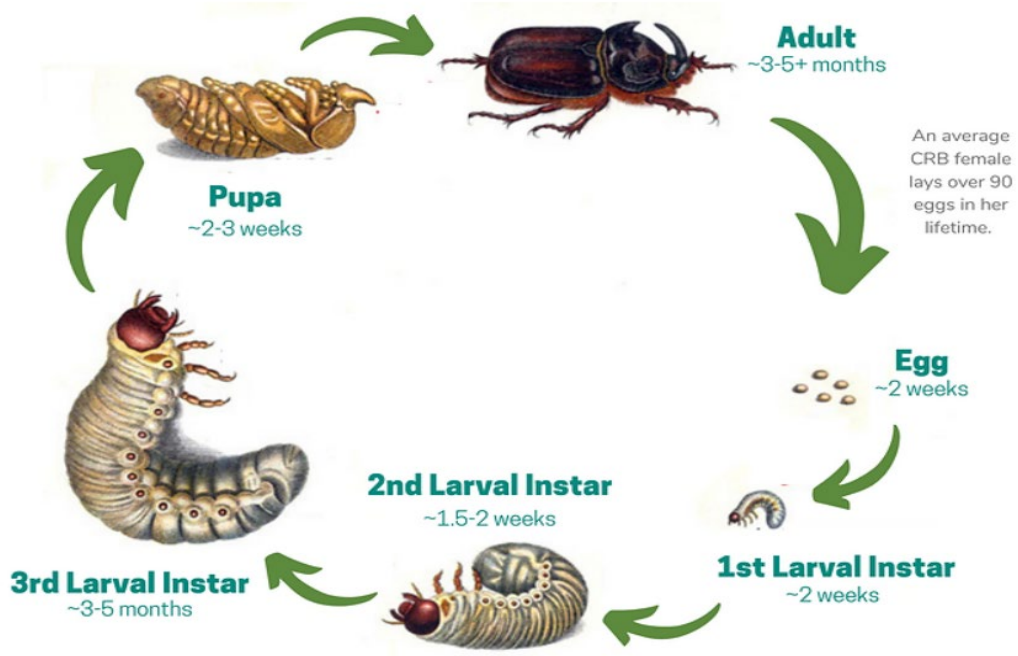
Don't forget about pests at or below the soil surface…
And nocturnal pests…

Key Steps in IPM

1. Correctly identify crop damage and responsible pest
2. Learn pest life cycle and biology

Example: Coconut Rhinoceros Beetle

Helps with understanding <u>what</u> types of intervention will be most effective and <u>when</u>



Coconut rhinoceros beetle life stages observed at 30 degrees Celsius. CRB breeding sites are typically established in decaying plant material like mulch, compost, decomposing stumps, or felled trees. After hatching from eggs, larvae begin feeding on the decomposing material. After growing through three larval stages, called instars, larvae pupate and emerge as an adult, leaving the breeding site. CRB spend roughly 5.5 months growing from an egg to an adult, and about 3 - 5 months as an adult.

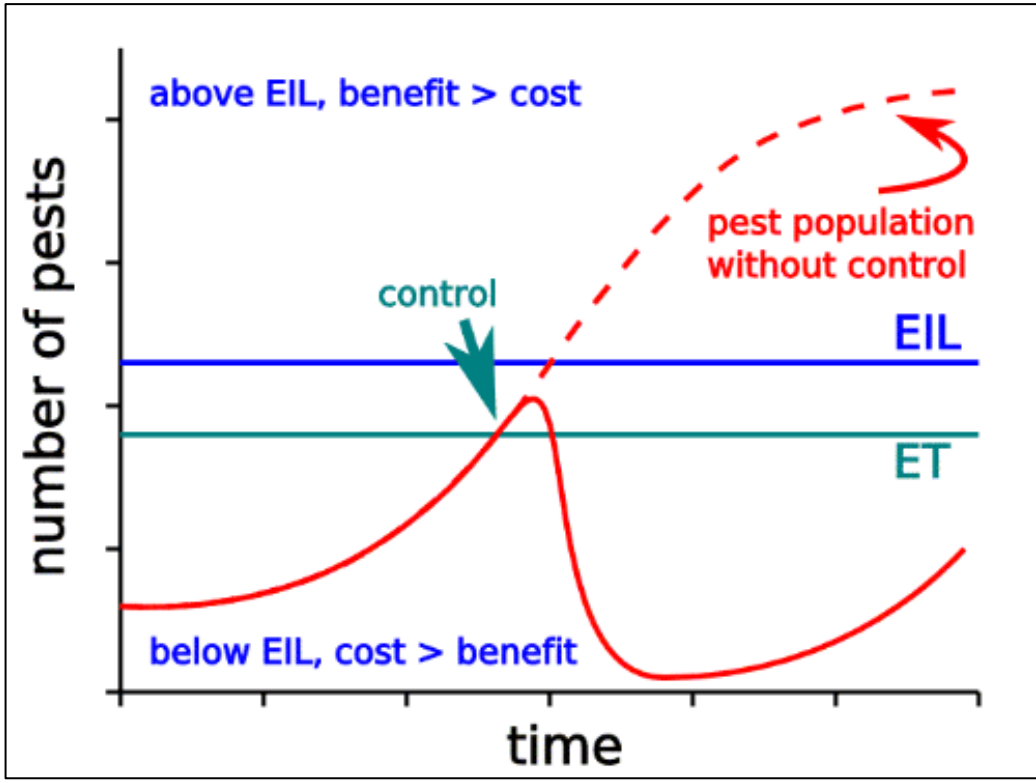
https://www.crbhawaii.org/coconut-rhinoceros-beetle

Key Steps in IPM

1. Correctly identify crop damage and responsible pest
2. Learn pest life cycle and biology
3. Establish action threshold

Goal of IPM is *not* to eliminate all pests; some level is tolerable and essential, so that natural enemies remain in the crop.

Economic Injury Level (EIL)



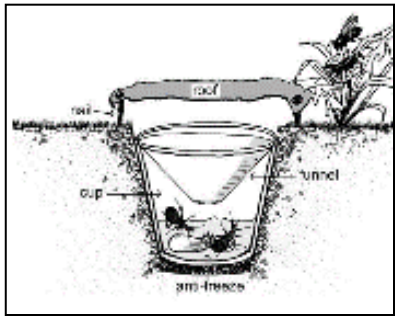
Credit: Ed Zaborski, University of Illinois

Key Steps in IPM

1. Correctly identify crop damage and responsible pest
2. Learn pest life cycle and biology
3. Establish action threshold
4. Monitor or sample for pest population

Sticky trap

Pheromone traps



Pitfall trap

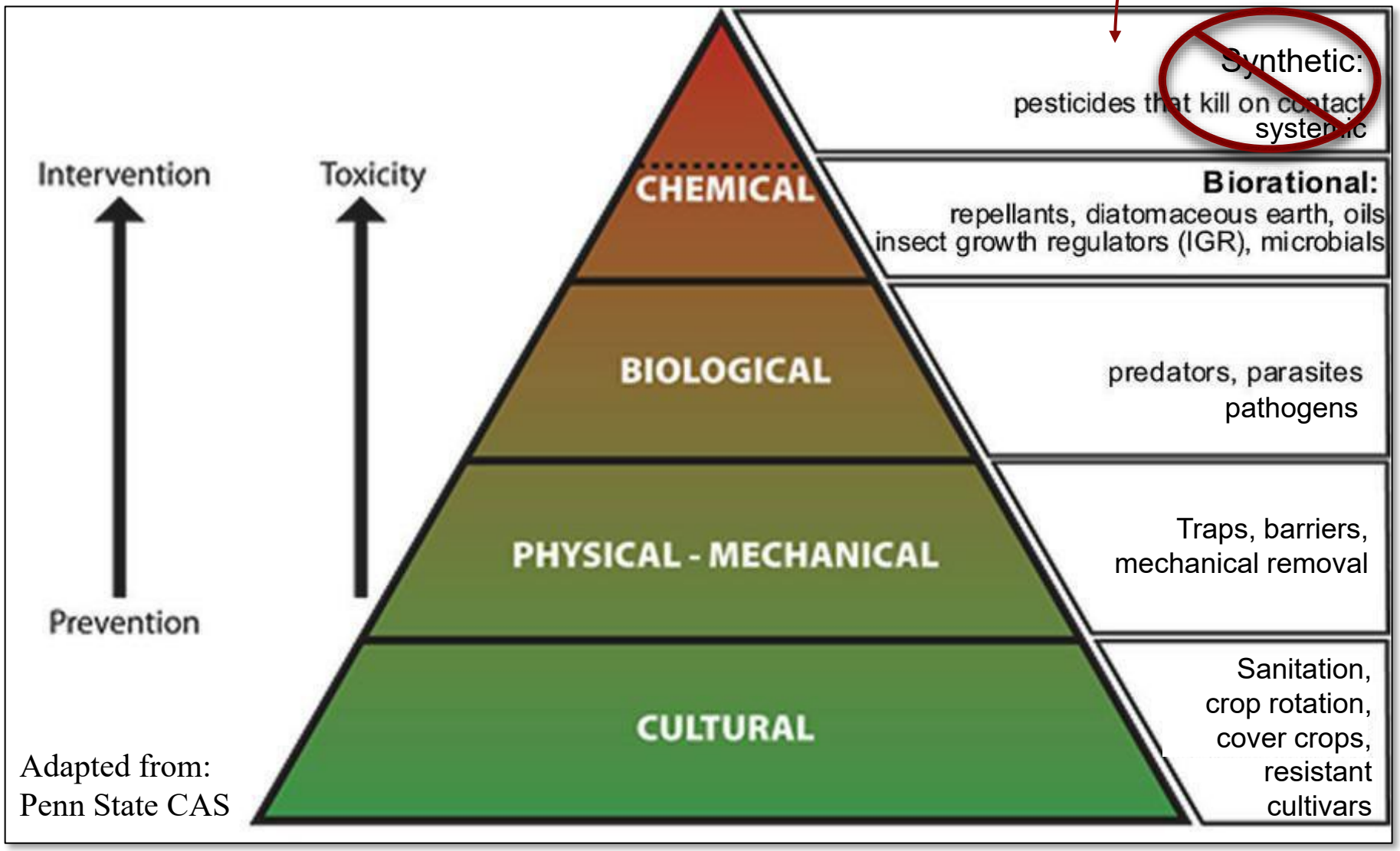
Malaise trap

Don't forget: notebook, hand lens, camera…..

Key Steps in IPM

1. Correctly identify crop damage and responsible pest
2. Learn pest life cycle and biology
3. Establish action threshold
4. Monitor or sample for pest population
5. Choose and apply combination of management tactics

Management Tactics



Start at the bottom – Prevention is the foundation

NOP Standard

§ 205.206 Crop pest, weed, and disease management practice standard.

(a) The producer must use **management practices** to prevent crop pests, weeds, and diseases including but not limited to:

(1) Crop rotation and soil and crop nutrient management practices, as provided for in § § 205.203 and 205.205;

(2) Sanitation measures to remove disease vectors, weed seeds, and habitat for pest organisms; and

(3) Cultural practices that enhance crop health, including selection of plant species and varieties with regard to suitability to site-specific conditions and resistance to prevalent pests, weeds, and diseases.

(b) Pest problems may be controlled through mechanical or physical methods including but not limited to:

(1) Augmentation or introduction of predators or parasites of the pest species;

(2) Development of habitat for natural enemies of pests;

(3) Nonsynthetic controls such as lures, traps, and repellents.

USDA National Organic Program Standard

§ 205.206 Crop pest, weed, and disease management practice standard.

(c) Weed problems may be controlled through:

(1) Mulching with fully biodegradable materials;

(2) Mowing;

(3) Livestock grazing;

(4) Hand weeding and mechanical cultivation;

(5) Flame, heat, or electrical means; or

(6) Plastic or other synthetic mulches: *Provided,* That, they are removed from the field at the end of the growing or harvest season.

(d) Disease problems may be controlled through:

(1) Management practices which suppress the spread of disease organisms; or

(2) Application of nonsynthetic biological, botanical, or mineral inputs.

NOP Standard

§ 205.206 Crop pest, weed, and disease management practice standard.

(e) When the practices provided for in paragraphs (a) through (d) of this section are insufficient to prevent or control crop pests, weeds, and diseases, a biological or botanical substance or a substance included on the National List of synthetic substances allowed for use in organic crop production may be applied to prevent, suppress, or control pests, weeds, or diseases: *Provided,* That, the conditions for using the substance are documented in the organic system plan.

"Allowed with Restrictions"

(f) The producer must not use lumber treated with arsenate or other prohibited materials for new installations or replacement purposes in contact with soil or livestock.

Cultural control is the foundation:

Modifications to normal plant care to reduce or avoid pest problems

- Sanitation
  - Remove overripe fruit
  - Removing diseased or infested plants
  - Clean equipment and tools
  - Use clean inputs (seeds, compost, etc.)
- Crop rotation
- Trap crops
- Resistant varieties
- Proper planting, fertilization, irrigation

Host plant resistance

Large (beefsteak) varieties are susceptible to fruit fly sting

Small (cherry) varieties seem more 'resistant'

Physical / mechanical control

- Traps

- Barriers
  - Bagging
  - Screenhouse
  - Row covers

- Hand picking – small scale

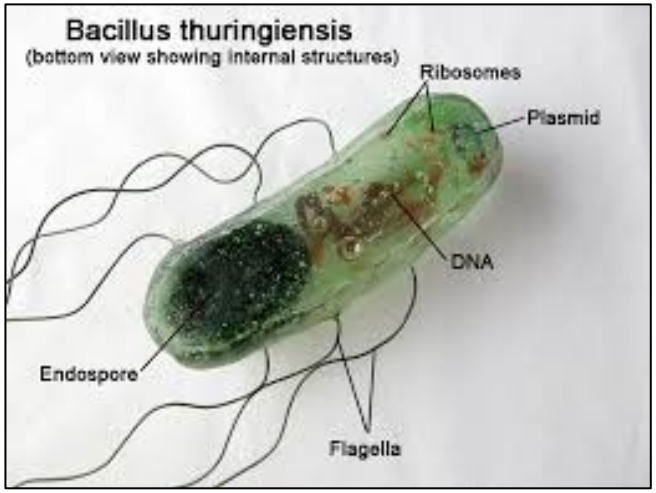
- Spraying high-pressured water – small scale

Biological control:

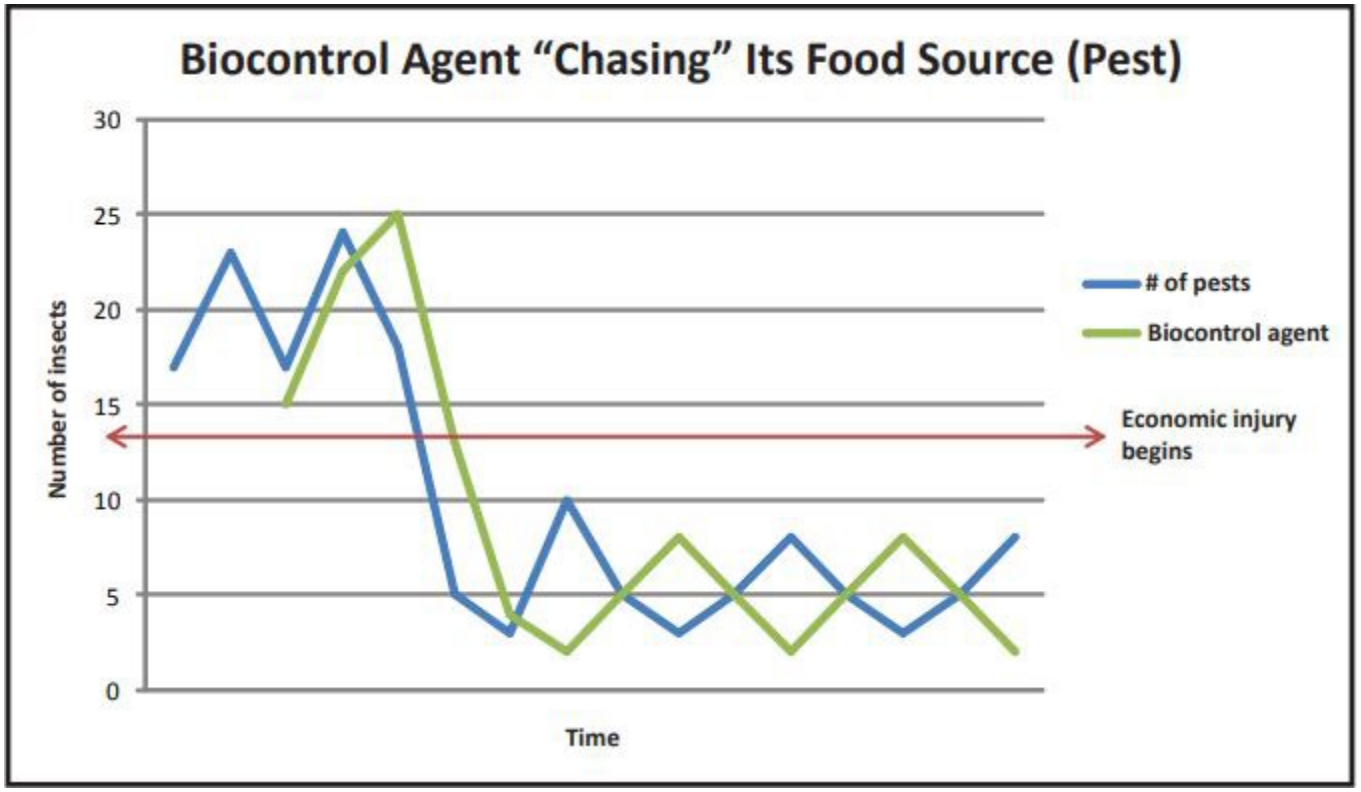
Predators

Parasitoids

Pathogens



Biological control: the use of natural enemies to reduce pest densities



Source: Utah State University Extension

Pesticides

Advantages:
Fast acting
Simple to use
Less management intensive
Costs off-loaded
Manage risk ("insurance")

Disadvantages:
Human health impacts
Non-target risks (beneficials, birds, fish, etc.)
Secondary pests outbreaks
Pest resistance

Remember:
the label is the law!!

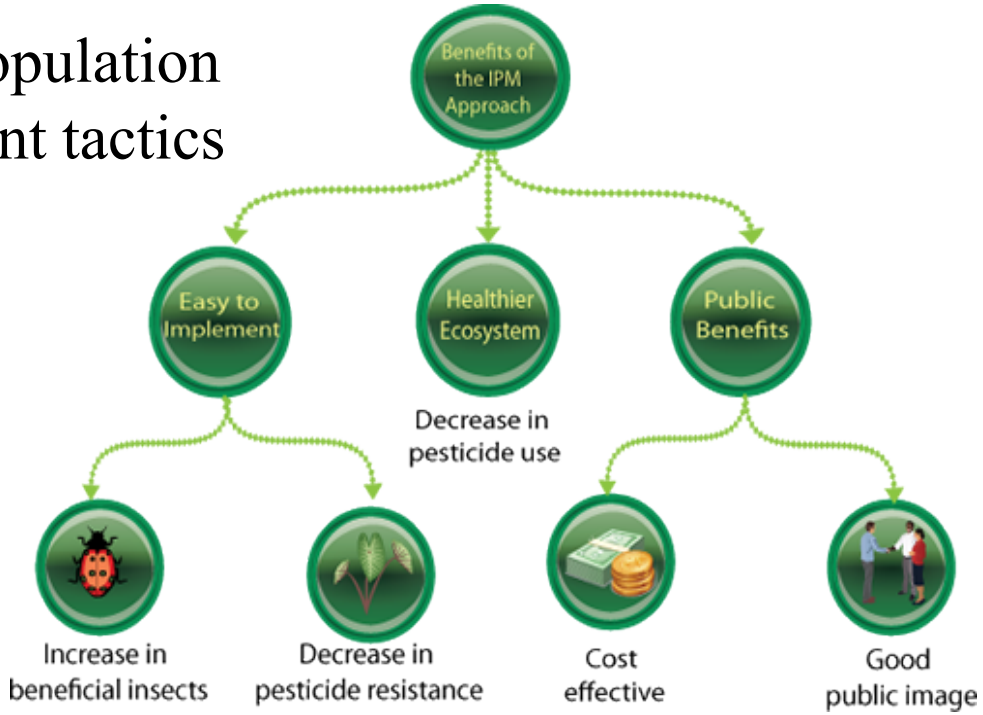
Commonly Used Active Ingredients in Organic Pesticides

1. Azadirachtin*
2. Bacillus thuringiensis (Bt)*
3. Copper-based compounds (e.g., copper sulfate, copper hydroxide)*
4. Pyrethrum (derived from chrysanthemum flowers)*
5. Spinosad (derived from Saccharopolyspora spinosa) *
6. Lime sulfur (calcium polysulfide)*
7. Hydrogen peroxide*
8. Potassium bicarbonate*
9. Garlic extract*
10. Neem oil*
11. Oils (e.g., sesame oil, soybean oil, horticultural petroleum oils)*

*Allowed with Restrictions. E.g. must implement cultural practices and recordkeeping as noted in **§ 205.206**

Key Steps in IPM

1. Correctly identify damage and pest
2. Learn pest life cycle and biology
3. Establish action threshold
4. Monitor or sample for pest population
5. Choose and apply management tactics
6. Evaluate results



Source: Springtime Irrigation

Mahalo!

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