

Protecting Food Resources: Pesticides & Pest Control

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OUTLINE

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 - biopesticides, hormones, & birth control
 - Integrated Pest Management

1. Types of Pesticides

Pesticides are chemicals used to kill undesirable organisms

- **insecticides**: insect killers
- **herbicides**: plant killers
- **fungicides**: fungus killers
- **nematocides**: round–worm killers
- **rodenticides**: rat & mouse killers

Types of Pesticides

1st generation pesticides

- mostly natural substances obtained from plants
- examples include pyrethrum & rotenone

2nd generation pesticides

- synthetic organic chemicals developed since 1945

Broad-spectrum: toxic to many species

Selective: toxic to a narrowly defined group

Persistent: remain in the environment for an extended period of time

Use of Pesticides

- Most pesticide use is in developed countries
- 90% of insecticides & 80% of herbicides applied to crops in the U.S. are used for growing cotton & corn
- the U.S. lawn is doused with 10x more pesticides per hectare than cropland

2. The Case For Pesticides

- **pesticides save human lives**
 - pesticides kill disease–carrying insects
- **pesticides increase food supplies & lower costs**
 - approximately 55% of the world's food supply is lost to pests
- **pesticides increase profits for farmers**
 - use of pesticides increases crop yields
- **pesticides work faster & better than alternatives**
- **new pesticides are used at low rates**

3. The Case Against Pesticides

The pesticide treadmill

- 1) Use of pesticides on a crop
- 2) Pests develop genetic resistance to pesticides
- 3) Dosage of pesticides increased or new pesticide is used
- 4) Pests develop genetic resistance to pesticides
- 5) repeat

The Case Against Pesticides

The pesticide treadmill – genetic resistance

Insects breed rapidly & within 5–10 years can develop immunity to pesticides through natural selection

Since 1950 at least 520 insects & mites, 273 weeds, 150 plant diseases, & 10 rodents have developed genetic resistance to one or more pesticides

(see Fig. 21–3)

The Case Against Pesticides

The pesticide treadmill – natural predators

- broad-spectrum insecticides also kill the natural predators & parasites of the target insect
- disappearance of predators allows previously unproblematic insects to become pests

The Case Against Pesticides

The pesticide treadmill

Although the use of synthetic pesticides has increased 33x since 1942, it is estimated that more of the U.S. food supply is lost to pests today than in the 1940s. Losses attributed to insects have almost doubled.

The Case Against Pesticides

Pesticides & Wildlife

- less than 2% of an insecticide applied by aerial or ground spraying reaches its target
- the chemicals end up in air, surface water, groundwater, food, & non-target organisms
- some pesticides biomagnify in food webs, poisoning or affecting the reproduction of top carnivores
- some pesticides run off into water bodies, harming aquatic animal & plant life

4. Other Methods of Pest Control

Cultivation practices

- crop rotation
- planting trap crops
- adjusting planting times
- intercropping & polyculture
- plantings to attract predators

Other Methods of Pest Control

Genetic engineering

- development of disease & pest resistant crop varieties
- could reduce the number & quantity of pesticides needed to protect crops

Video: http://www.history.com/media.do?action=clip&id=mm_gmpesticide_broadband

Potential limitations

- eventual pest adaptation to new crops
- resistance factors may be toxic to beneficial insects & other animals

Other Methods of Pest Control

Biopesticides, Hormones, & Birth Control

Biopesticides:

- plant toxins synthesized for mass production
- microbes toxic to plants

Hormones:

- pheromones to lure pests into traps

Birth control:

- release of sterile males

Biological Control

Example: For normal insect growth, development, & reproduction to occur, certain juvenile hormones (JH) & molting hormones (MH) must be present at appropriate stages of the life cycle. If applied at the proper time, synthetic hormones disrupt the life cycles of insect pests & control their population.

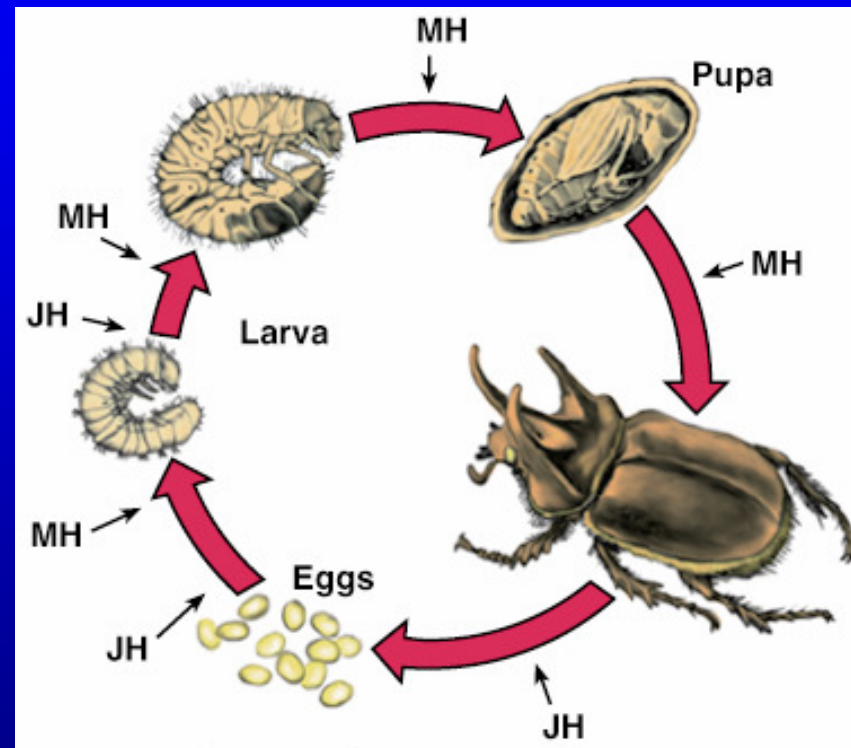


Fig. 21-10

Other Methods of Pest Control

Integrated Pest Management

Each crop & its pests are evaluated as parts of an ecological system. A control program is developed that includes a mix of cultivation, biological & chemical control methods.

- 1) crops monitored for damaging levels of pests
- 2) biological control methods used
- 3) small amounts of diverse chemicals used to prevent development of resistance & to avoid killing beneficial insects & predators

Integrated Pest Management

The goal of integrated pest management is to keep each pest population just below the size at which it causes economic loss.

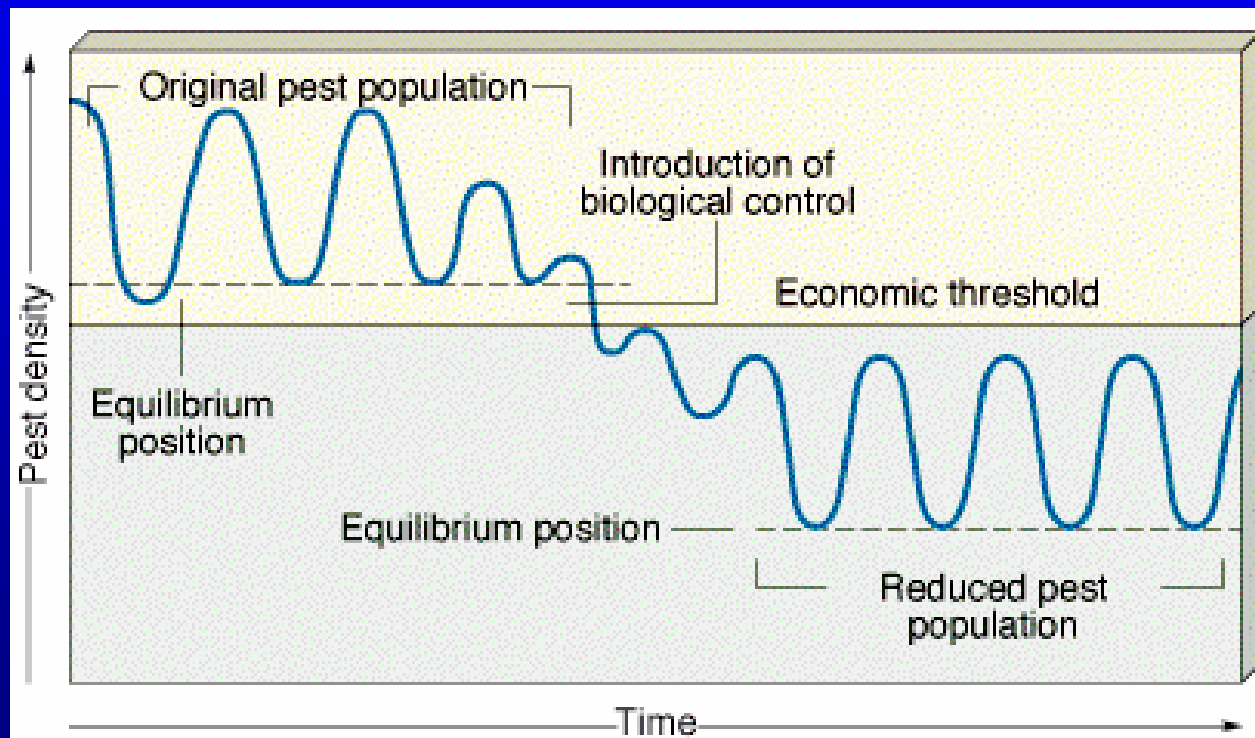


Fig. 21-12