Chapter 13

Pest Management

Pests

• Compete with humans for food
• Invade lawns and gardens
• Destroy wood in houses
• Spread disease
• Are a nuisance
• May be controlled by natural enemies
### Pesticides: Types

- Chemicals that kill undesirable organisms
- Insecticides
- Herbicides
- Fungicides
- Rodenticides

### First Generation Pesticides

- Primarily natural substances
- Sulfur, lead, arsenic, mercury
- Plant extracts: nicotine, pyrethrum
- Plant extracts are degradable
Second Generation Pesticides

- Primarily synthetic organic compounds
- 630 biologically-active compounds
- Broad-spectrum agents
- Narrow-spectrum agents
- Target species
- Nontarget species

The Case for Pesticides

- Save human lives
- Increase supplies and lower cost of food
- Work better and faster than alternatives
- Health risks may be insignificant compared to benefits
- Newer pesticides are becoming safer
- New pesticides are used at lower rates
The ideal Pesticide and the Nightmare Insect Pest

The ideal pest-killing chemical has these qualities:

- Kill only target pest.
- Not cause genetic resistance in the target organism.
- Disappear or break down into harmless chemicals after doing its job.
- Be more cost-effective than doing nothing.

Integrated Pest Management

- Ecological system approach
- Reduce pest populations to economic threshold
- Field monitoring of pest populations
- Use of biological agents
- Chemical pesticides are last resort
PROTECTING FOOD RESOURCES: PEST MANAGEMENT

- We use chemicals to repel or kill pest organisms as plants have done for millions of years.
- Chemists have developed hundreds of chemicals (pesticides) that can kill or repel pests.
  - Pesticides vary in their persistence.
  - Each year > 250,000 people in the U.S. become ill from household pesticides.
Animation: Pesticide Examples

Protecting Food Resources: Pest Management

Advantages
- Save lives
- Increase food supplies
- Profitable to use
- Work fast
- Safe if used properly

Disadvantages
- Promote genetic resistance
- Kill natural pest enemies
- Create new pest species
- Pollute the environment
- Can harm wildlife and people

Advantages and disadvantages of conventional chemical pesticides.

Figure 13-28
Individuals Matter: Rachel Carson

- **Wrote** *Silent Spring* which introduced the U.S. to the dangers of the pesticide DDT and related compounds to the environment.
- **Bioaccumulation & biomagnification**

The Case Against Pesticides

- Genetic resistance
- Can kill nontarget and natural control species
- Can cause an increase in other pest species
- The pesticide treadmill
- Pesticides do not stay put
- Can harm wildlife
- Potential human health threats
Superpests

- Superpests are resistant to pesticides.
- Superpests like the silver whitefly (left) challenge farmers as they cause > $200 million per year in U.S. crop losses.

Figure 13-29

Pesticide Regulation in the United States

- Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- Tolerance levels
- EPA Evaluation of chemicals
- Inadequate and poorly enforced
- Food Quality Protection Act (FQPA)
Pesticide Protection Laws in the U.S.

- Government regulation has banned a number of harmful pesticides but some scientists call for strengthening pesticide laws.
  - The Environmental Protection Agency (EPA), the Department of Agriculture (USDA), and the Food and Drug Administration (FDA) regulate the sales of pesticides under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA).
  - The EPA has only evaluated the health effects of 10% of the active ingredients of all pesticides.

How Would You Vote?

- Do the advantages of using synthetic chemical pesticides outweigh their disadvantages?
  - a. No. Synthetic pesticides are overused, damage the environment, and increase cancer risks.
  - b. Yes. Pesticides save human lives and protect crops.
What Can You Do?

Reducing Exposure to Pesticides

- Grow some of your food using organic methods.
- Buy organic food.
- Wash and scrub all fresh fruits, vegetables, and wild foods you pick.
- Eat less or no meat.
- Trim the fat from meat.

Other Ways to Control Pests

There are cultivation, biological, and ecological alternatives to conventional chemical pesticides.

- Fool the pest through cultivation practices.
- Provide homes for the pest enemies.
- Implant genetic resistance.
- Biological pest control. Bring in natural enemies.
- Biopesticides. Use pheromones to lure pests into traps.
- Insect birth control. Use hormones to disrupt life cycles.
- Economic threshold
PROTECTING FOOD RESOURCES: PEST MANAGEMENT

Organisms found in nature (such as spiders) control populations of most pest species as part of the earth’s free ecological services.

Other Ways to Control Pests

**Biological pest control:** Wasp parasitizing a gypsy moth caterpillar.
Other Ways to Control Pests

- Genetic engineering can be used to develop pest and disease resistant crop strains.
- Both tomato plants were exposed to destructive caterpillars. The genetically altered plant (right) shows little damage.

Case Study: integrated Pest Management: A Component of Sustainable Agriculture

- An ecological approach to pest control uses a mix of cultivation and biological methods, and small amounts of selected chemical pesticides as a last resort.
  - Integrated Pest Management (IPM)
Case Study: integrated Pest Management: A Component of Sustainable Agriculture

- Many scientists urge the USDA to use three strategies to promote IPM in the U.S.:
  - Add a 2% sales tax on pesticides.
  - Establish federally supported IPM demonstration project for farmers.
  - Train USDA personnel and county farm agents in IPM.
- The pesticide industry opposes such measures.

How Would You Vote?

- Should governments heavily subsidize a switch to integrated pest management?
  - a. No. Without extensive funding and training, mere subsidies are not enough to successfully promote integrated pest management.
  - b. Yes. These subsidies would decrease pollution and exposure to hazardous pesticides.