

Lesson C11–3:

Using Pesticides Safely

Unit C. Plant and Soil Science

Problem Area II. Pesticide Use

Lesson 3. Using Pesticides Safely

Learning Goal: Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences.

Learning Standard: Know and apply concepts that explain how living things function, adapt and change.

Learning Benchmark: Explain how genetic combinations produce visible effects and variations among physical features and cellular functions of organisms.

Occupational Skill Standard: Spray a 20-acre row crop field with pesticides.

Workplace Skills: Identify work-related terminology. Identify the problem. Identify hazardous substances in the workplace.

Student Learning Objectives. Instruction in this lesson should result in students achieving the following objectives:

1. Explain the way pesticides are classified according to toxicity.
2. Identify the types of pesticide exposure.
3. Explain how toxicity is measured.
4. Identify the safety practices that should be followed when applying pesticides.

List of Resources. The following resources may be useful in teaching this lesson:

Recommended Resources. One of the following resources should be selected to accompany the lesson:

Biondo, Ronald J. and Jasper S. Lee. *Introduction to Plant and Soil Science and Technology*. Danville, Illinois: Interstate Publishers, Inc., 1997. (Textbook and Activity Manual, Chapter 12)

Schroeder, Charles B. et al. *Introduction to Horticulture: Science and Technology*. Danville, Illinois: Interstate Publishers, Inc., 2000. (Textbook, Chapter 9)

Other Resources. The following resources will be useful to students and teachers:

Reiley, H. Edward and Carroll L. Shry, Jr. *Introductory Horticulture*. Albany, New York: Delmar Publishers, 1997. (Textbook and Lab Manual, Unit 17)

VAS U4082, *Using Farm Chemicals Safely*. Urbana, Illinois: Vocational Agriculture Service.

List of Equipment, Tools, Supplies, and Facilities

Writing surface

Overhead projector

Transparencies from attached masters

Copies of student lab sheet

Terms. The following terms are presented in this lesson (shown in bold italics):

Applicator

Dermal exposure

Eye exposure

General-use pesticides

Inhalation exposure

LC₅₀

LD₅₀

Lethal dose

Oral exposure

Restricted-use pesticides

Toxicity

Worker Protection Standard (WPS)

Interest Approach. Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. A possible approach is included here:

Begin a discussion with your students about the law in some states that requires everyone in the front seat of a car to wear a seat belt. Have the students express their opinions on this law. Ask them why such a law was passed. Lead the discussion to the point that it is important for people to wear seat belts to help protect them in a crash. Though they may seem uncomfortable, seat belts do help save lives. Relate this to the fact that it is important to wear the proper equipment and follow proper safety procedures when using pesticides. Just like not knowing when you will be in a car accident, no one knows when you could get exposed to pesticides.

Summary of Content and Teaching Strategies

Objective 1: Explain the way pesticides are classified according to toxicity.

Anticipated Problem: How are pesticides classified according to toxicity?

- I. **Toxicity** refers to the degree of poison in a material. Some pesticides are more toxic than others. The amount of active ingredient in a material as well as the chemical nature of the poison determines toxicity. Pesticides are classified into two categories:
 - A. **General-use pesticides** can be more widely used by following the label instructions. These pesticides are less hazardous to the environment. In most cases, special training in applying the pesticide is not required.
 - B. **Restricted-use pesticides** have higher toxicity levels than general-use pesticides. Risk is greater to humans and the environment. Anyone who applies these pesticides must have special training in the safe use and handling of these chemicals.

Use a variety of techniques to help students master this objective. Students should use text materials to help understand the classification of pesticides according to toxicity. Chapter 12 of the Introduction to Plant and Soil Science and Technology is recommended. Use TM: C11–3A to assist in the discussion of this topic.

Objective 2: Identify the types of pesticide exposure.

Anticipated Problem: What are the different types of pesticide exposure?

- II. Before a pesticide can harm anyone, the person must first be exposed. There are four main routes that a pesticide can enter the body. They are:
 - A. **Oral Exposure** (through the mouth and digestive system)—This exposure may occur because of an accident, but is more likely to be the result of carelessness. Blowing out a

plugged nozzle with your mouth or smoking or eating without washing contaminated hands can result in oral exposure.

- B. **Dermal Exposure** (through the skin)—This type of exposure can occur anytime a pesticide is mixed, applied, or handled. The severity of dermal exposure depends on the dermal toxicity of the material, the rate of absorption through the skin, the size of the skin area contaminated, and the length of time the material is in contact with the skin.
- C. **Inhalation Exposure** (through the nose and respiratory system)—This type of exposure results from breathing pesticide vapors, dusts, or spray particles. In some cases, inhalation can be more serious than oral or dermal exposure due to the uptake of blood via the lungs and other membranes.
- D. **Eye Exposure** (through the eye)—Eyes are very sensitive to most pesticide materials. Eye protection should be worn when working with any pesticide.

Use a variety of techniques to help students master this objective. Students should use text materials to help understand the types of pesticide exposure. VAS U4082 “Using Farm Chemicals Safely” is recommended. Use TM: C11–3B to assist in the discussion of dermal exposure.

Objective 3: Explain how toxicity is measured.

Anticipated Problem: How is toxicity measured?

- III. The method used to measure toxicity differs slightly between the different types of exposure.
 - A. The method used to measure oral and dermal toxicity is **LD₅₀**. The LD stands for **lethal dose**, which means the amount necessary to cause death. The 50 means that 50 percent of the test animals are killed at this dose. The lower the LD₅₀ number of a pesticide, the more poisonous it is. LD₅₀ values are given in milligrams of substance per kilogram of test animal body weight. This is equivalent to parts per million.
 - B. The method used to measure inhalation toxicity is **LC₅₀**. LC stands for lethal concentration. LC₅₀ values are measured in milligrams per liter. The lower the LC₅₀ number, the more poisonous the pesticide.

Use a variety of techniques to help students master this objective. Students should use text materials to help understand the way pesticide toxicity is measured. Unit 17 of the Introductory Horticulture textbook is recommended. Use TM: C11–3C to assist in the discussion of oral and dermal exposure toxicity.

Objective 4: Identify the safety practices that should be followed when applying pesticides

Anticipated Problem: What safety practices should be followed when applying pesticides?

- IV. Pesticides are a useful and productive tool used in production agriculture and horticulture; however, pesticides can pollute the environment and contaminate water and food supplies if not used properly. These chemicals can be dangerous to the applicator and other people and animals in the area if a few simple safety practices are not followed. A concern for worker

protection dealing with pesticide application has led to the passage of a new **Worker Protection Standard (WPS)**. The law presents a set of rules that are designed to reduce the number of pesticide-related illnesses. These rules do not regulate or ban any chemical. Rather, they provide guidelines for workers to follow during and after application. The following is a general list of safety practices to follow when using pesticides.

- A. Use only approved pesticides—Government regulations allow only certain pesticides to be used.
- B. Know the pesticide—The **applicator** (person who applies the pesticide) must be informed about all aspects of the chemical. Labels on the containers provide much of the needed information. Use the pesticide according to the directions. Do not use pesticides for uses that they were not intended for.
- C. Use a pesticide with low toxicity—Toxicity refers to how poisonous the pesticide is. Use the pesticide that will do what needs to be done, but that is no stronger than needed.
- D. Use pesticides only when needed—Pesticides should only be used when pests need to be controlled. Using a pesticide without need damages the environment and wastes money.
- E. Do not contaminate resources—Pesticides can pollute the environment. They should never be dumped into streams or on the ground. Leftover pesticides should be disposed of properly following all federal, state, and local regulations.
- F. Wear protective clothing—Applicators need to protect themselves from pesticides when they are applying them. They should always wear protective clothing such as rubber gloves, a respirator, and any other protective gear called for on the label. The clothing should be properly washed after it is worn.
- G. Dispose of empty containers properly—Empty containers should never be thrown into creeks or gullies. Some manufactures take empty containers back. Generally, empty containers should be rinsed out three times and returned for recycling or sent to an approved solid waste facility.
- H. Apply in good weather—Pesticides should be used when they will be most effective. Wind causes pesticides to drift. Sometimes drifting pesticides can damage other crops, water, or livestock.
- I. Use the right equipment—This includes funnels to help in pouring, measuring, and mixing. Spraying equipment should be adjusted properly so it applies no more than is needed. This is important not only to protect the environment, but to save the producer as well.
- J. Know the right emergency measures—Anyone who applies, or is around people who are applying pesticides should know what to do in case of an accident. Local physicians know whom to contact for help when people have been poisoned. You should always have the emergency telephone numbers nearby.

Use a variety of techniques to help students master this objective. Students should use text materials to help understand the safety practices that should be used when applying pesticides. Chapter 9 of the Introduction to Horticulture textbook is recommended. Use TM: C11–3D to assist in the discussion on protective

clothing that should be worn when applying pesticides. Refer to Lesson C11–5: *Applying Pesticides* for more information on this topic.

Review/Summary. Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at the end of each chapter in the recommended textbooks may also be used in the review/summary.

Application. Application can involve the following student activity using the attached lab sheet:

LS: C11–3A: Protective Equipment: You want me to wear what?—Demonstration

Evaluation. Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activity. A sample written test is attached.

Answers to Sample Test:

Part One: Matching

1=f, 2=e, 3=i, 4=a, 5=d, 6=j, 7=h, 8=c, 9=g, 10=b

Part Two: Completion

1. more
2. Worker Protection Standard (WPS)
3. accident
4. toxicity

Part Three: Short Answer

1. a) General-use pesticide
b) Restricted-use pesticide

Test

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Part One: Matching

Instructions. Match the term with the correct response. Write the letter of the term by the definition.

- | | | |
|------------------|---------------------|------------------------|
| a. toxicity | e. dermal exposure | i. applicator |
| b. oral exposure | f. LD ₅₀ | j. inhalation exposure |
| c. eye exposure | g. restricted-use | |
| d. general-use | h. LC ₅₀ | |

- _____ 1. Measurement of oral and dermal toxicity.
- _____ 2. Pesticides entering the body through the skin.
- _____ 3. Person who applies pesticides.
- _____ 4. Degree of poison in a material.
- _____ 5. A pesticide that can be more widely used by following the label instructions without special training.
- _____ 6. Pesticides entering the body through the nose and respiratory system.
- _____ 7. Measurement of inhalation toxicity.
- _____ 8. Pesticides entering the body through the eyes.
- _____ 9. Pesticides that have higher toxicity levels and anyone who applies them must have special training.
- _____ 10. Pesticides entering the body through the mouth and digestive system.

Part Two: Completion

Instructions. Provide the word or words to complete the following statements.

1. The lower the LC₅₀ number, the _____ poisonous the pesticide.
2. A concern for worker protection dealing with pesticide application has led to the passage of a new _____.
3. Anyone who applies or is around people who are applying pesticides should know what to do in case of an _____.
4. The amount of active ingredient in a material as well as the chemical nature of the poison determines _____.

Part Three: Short Answer

Instructions. Provide information to answer the following questions.

1. What two categories can pesticides be placed in according to toxicity?

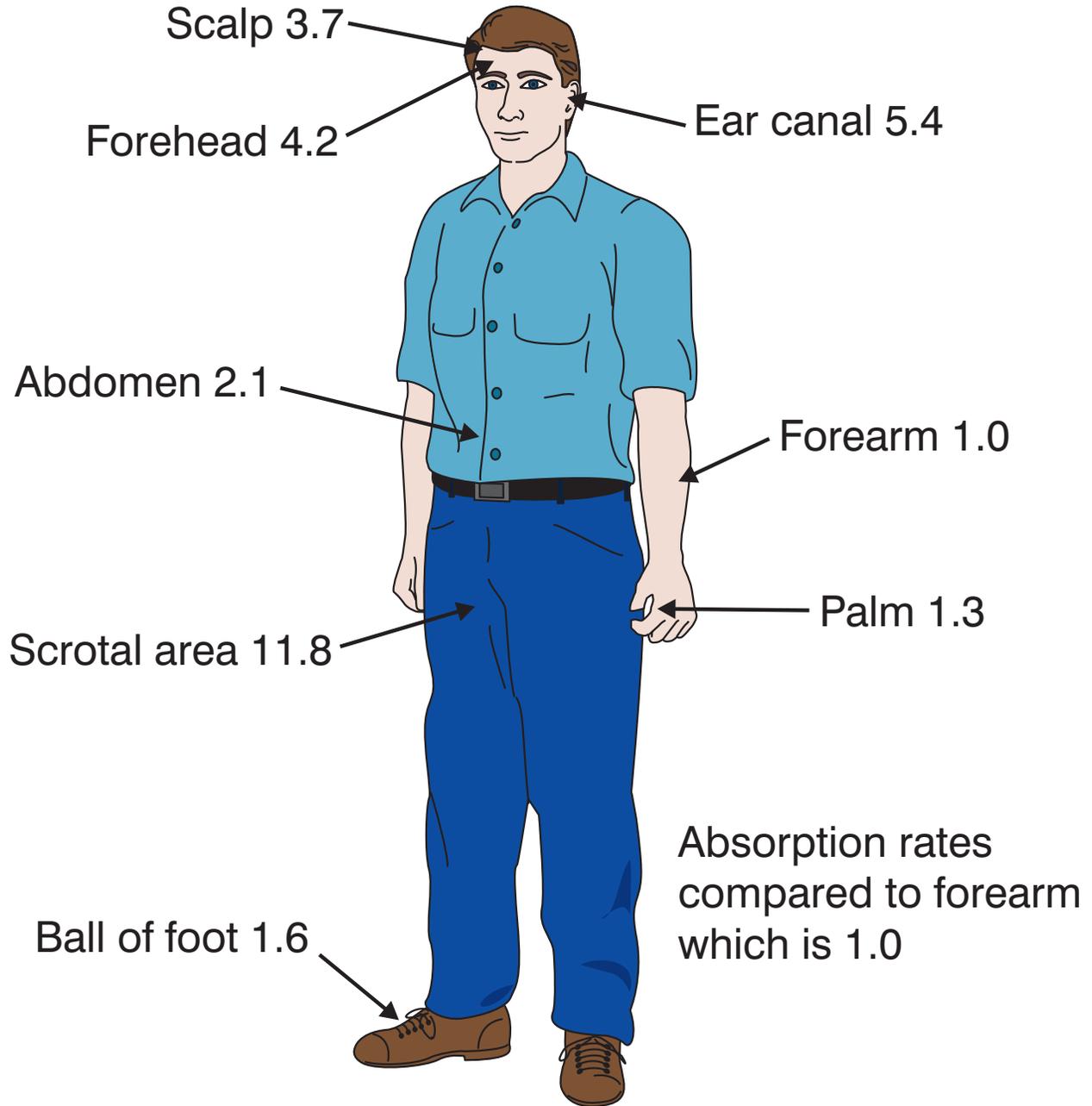
a)

b)

PESTICIDE CATEGORIES (ACCORDING TO TOXICITY)

- **General-use Pesticides**
- **Restricted-use Pesticides**

DERMAL EXPOSURE

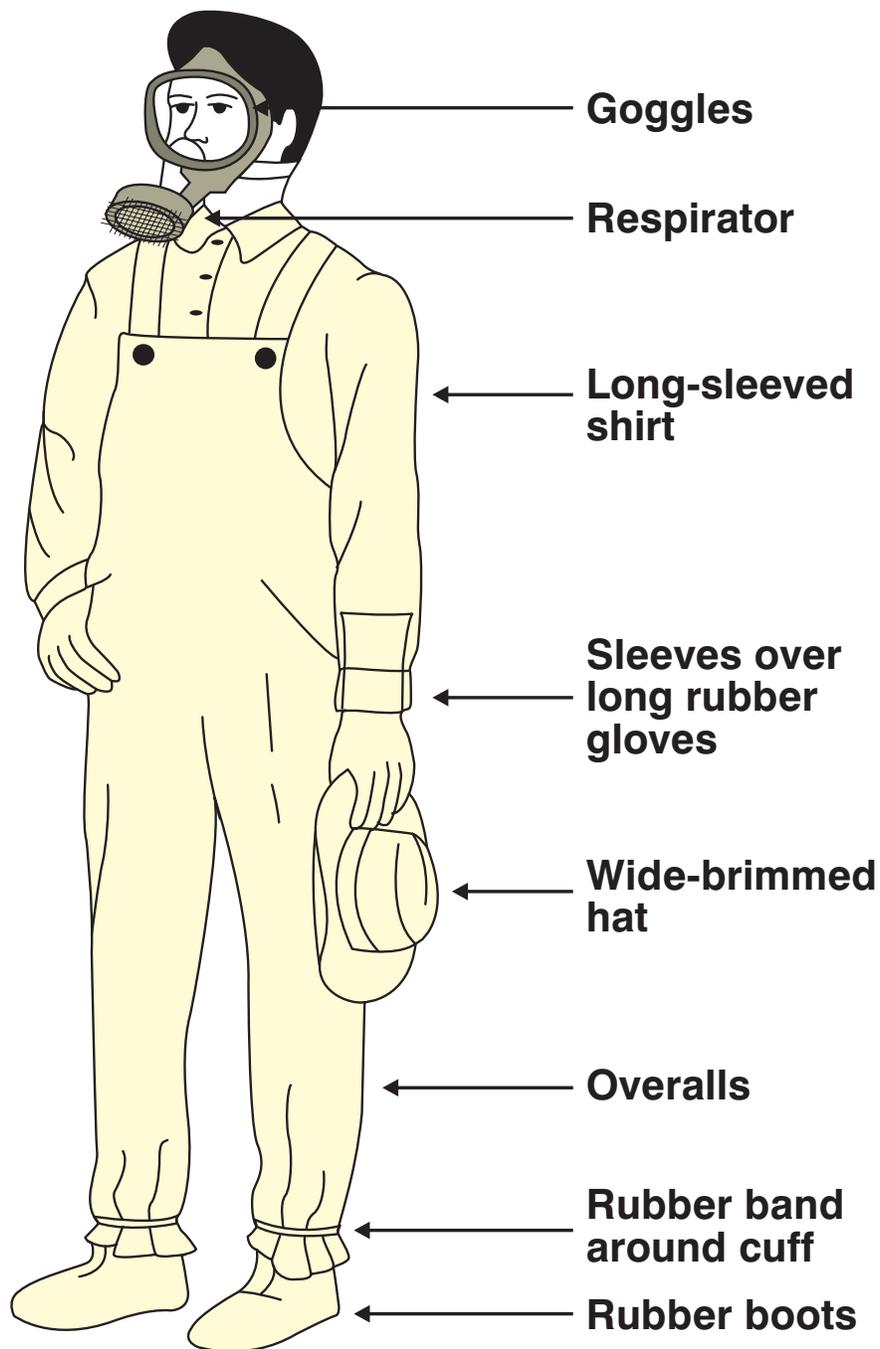


ACUTE TOXICITY

PESTICIDE NAME	Oral (by mouth) (rats)	DERMAL (on skin) (rabbits)	TYPE OF PESTICIDE OR USE
✓aldicarb (Temik)	0.9	5	insecticide
✓demeton (Systox)	2	8	insecticide
✓parathion	3	6.5	insecticide
✓carbophenothion (Trithion)	6	22	insecticide
✓azinphos-methyl (Guthioin)	16	220	insecticide
Zinc phosphide	45		Mouse poison
nicotine	50	50	insecticide
warfarin	1 to 186		Mouse and rat poison
Bifenthrin (Capture)	50	>2,000	insecticide
rotenone	60	1,000	insecticide
lindane	88	500	insecticide
PCP (penta)	100	100	Wood preservative
dursban	135	200	insecticide
caffein	200		beverage
Metaldehyde (Deadline)	250		Snails and slugs
diazinon	300	379	insecticide
Carbaryl (Sevin)	307	2,000	insecticide
2, 4-D	375	1,500	herbicide
Nabam (Dithane)	394		fungicide

PESTICIDE NAME	Oral (by mouth) (rats)	DERMAL (on skin) (rabbits)	TYPE OF PESTICIDE OR USE
Dicofol (Kelthane)	575	4,000	miticide
Metalaxl (Subdue)	669	3,100	Systemic fungicide
aspirin	750		Pain killer
Acephate (Orthene)	866	2,000	Systemic insecticide
Malathion (Cythion)	885	4,100	insecticide
EPTC	1,367	10,000	herbicide
Atrazine (Aatrex)	1,869	> 3,100	herbicide
resmethrin	2,000	2,500	insecticide
dichlobenil	3,160	1,350	herbicide
Table salt	3,320		Mineral food item
Cyromazine (Larvadex)	3,387	3,387	insecticide
Trifluralin (Treflan)	3,700	3,000	herbicide
Ethyl alcohol	4,500		beverage
borax	4,980		Cleaning compound insecticide
azadirachtin	5,000		Insecticide from neem tree
Simazine (Princep)	5,000	> 3,100	herbicide
glyphosphate	5,600	5,600	herbicide
oxyfluorfen	5,600	> 10,000	herbicide
Fosetyl (Aliette)	5,800	3,200	Systemic fungicide
Daminoxide (Alar, B-Nine)	8,400	1,600	Growth retardant
captan	9,000		fungicide
kerosene	28,000		fuel

PROTECTIVE CLOTHING



Lab Sheet

Protective Equipment: You want me to wear what?—Demonstration

Contact a local pesticide applicator. Ask them to speak to your class about the safety precautions their employees take when applying pesticides. Ask them to bring in examples of all of the equipment they wear when applying chemicals. During the demonstration, have at least one student try on the protective gear.