

GREENHOUSE OPERATION AND MANAGEMENT

Unit VI: Plant Health

Lesson 3: Pesticide Use and Safety

Competency/Objective:

Explain safe usage and application of pesticides.

Study Questions

- 1. What information is found on a pesticide label?**
- 2. What are pesticide toxicity levels?**
- 3. In what forms are pesticides available and how should they be applied?**
- 4. What is the mode of action for different types of pesticides?**
- 5. What basic pesticide safety issues must be understood?**
- 6. What are general procedures for pesticide storage and disposal?**
- 7. What personal protection measures are essential when applying pesticides?**
- 8. What are the appropriate steps to take in case of accidental pesticide poisoning?**
- 9. Where can greenhouse owners find up-to-date pesticide information and recommendations?**
- 10. What certifications are required to use pesticides?**

References/Supplies/Materials

- Greenhouse Operation and Management* (Student Reference). University of Missouri-Columbia: Instructional Materials Laboratory, 2002.
- Transparency Masters
 - TM 6.12 Sample Pesticide Label
 - TM 6.13 Types of Sprayers Used to Apply Pesticides
 - TM 6.14 Sample Pesticide Application Log

Greenhouse Operation and Management

3. Activity Sheets

AS 6.5 Pesticide Dilution Ratios

AS 6.6 Pesticide Update

4. *Pesticide Safety*. University of Missouri-Columbia: Instructional Materials Laboratory, RAS 1997 (catalog numbers 10-6050-I and 10-6050-S).
5. *Applying Pesticides Correctly: Missouri Core Manual*. University of Missouri Extension, 1994 (catalog number 10-6060-S).
6. Fishel, Fred. "Integrated Pest Management in Missouri's Urban Environment" Integrated Pest Management - MU Guide. University of Missouri-Columbia Extension. <<http://muextension.missouri.edu/xplor/agguides/pests/ipm1004.htm>>
7. Fishel, Fred. "Pesticide Dilution Table." Agricultural publication G7510, reprinted January 15, 2001. Department of Agronomy, University of Missouri-Columbia. <<http://muextension.missouri.edu/xplor/agguides/pests/g07510.htm>> accessed 5/9/02.
8. "Geiger Company Supplemental Catalog." <http://www.geigerco.com/labels_msds/2001_cat.pdf> accessed 5/9/02.
9. "Pesticides - Certified Applicators and Operator (Commercial, Non-Commercial and Public)." Missouri Department of Agriculture. Pest Management. <<http://www.mda.state.mo.us/d7c.htm>> accessed 5/9/02.

TEACHING PROCEDURES

A. Review

Many pests and diseases are common in greenhouses. Students learned to recognize these pests in Lessons 1 and 2. Lesson 3 discusses pesticide labels, usage, toxicity, and application methods.

B. Motivation

Ask students to identify common pesticides that they have used for their own crops. What hazards do they pose? How should authorized personnel apply pesticides?

C. Assignment of Study Questions

D. Supervised Study

Lead students in collecting the information needed to answer and discuss the study questions. The instructor may choose to work on one study question at a time or have students answer all the study questions before the discussion. Another option is to have students work in a cooperative learning environment and have groups work on different study question.

E. Discussion

Lead students in a discussion of the study questions. Supplement students' responses and information with additional materials when needed.

1. What information is found on a pesticide label?

A pesticide label contains important information relating to the product's chemicals. Details about the ingredients and their use, warning statements, and EPA registration are provided. See TM 6.12.

- A. Pesticide labels are extremely important.
- B. The label is the law.
 - 1. Indicates legal use, storage, and disposal methods
 - 2. Controls sale and distribution
- C. Label directions contain essential information.
 - 1. Ingredients (including chemical names)
 - 2. Type of pesticide and what it is designed to control
 - 3. Amount of contents
 - 4. Signal words (Caution, Warning, Danger)
 - 5. Routes of entry (user's body parts that must be protected)
 - 6. Specific action (action taken to prevent poisoning)
 - a. Type of clothing and equipment that should be worn
 - b. Hazards (environmental, physical, chemical)
 - c. Specific toxicity (to certain plant or animal life)
 - d. Recommended first aid in case of accidental poisoning
 - e. EPA classification
 - f. Directions for proper use
 - g. Storage and disposal directions
 - h. Safe reentry time (time before entering area without protective clothing and gear)
- D. Read all label information and strictly adhere to all label directions.

2. What are pesticide toxicity levels?

Pesticide toxicity levels have specific definitions for caution, warning, and danger. Ask students how they think toxic pesticides might come into contact with humans.

- A. Pesticide toxicity levels are measured by an LD₅₀ test.
- B. The LD₅₀ level is a lethal dose of a pesticide that is necessary to kill 50% of test animals within 2 weeks.
 - 1. Expressed in milligrams of per kilogram of test animal's body weight
 - 2. The lower the LD₅₀ number, the greater the pesticide toxicity and less needed to kill
- C. There are three kinds of toxicity.
 - 1. Oral (ingested)
 - 2. Inhaled (breathed)
 - 3. Dermal (absorbed through skin)

Greenhouse Operation and Management

- D. Pesticide labels use signal words based on toxicity levels.
 - 1. Caution
 - a. Slightly toxic
 - b. Oral LD₅₀ rating: 500-5,000
 - 2. Warning
 - a. Moderately toxic
 - b. Oral LD₅₀ rating: 50-500
 - 3. Danger or Danger Poison
 - a. Highly toxic
 - b. Oral LD₅₀ rating: 0-50
 - c. Letters printed in red and accompanied by a skull and crossbones drawing

3. In what forms are pesticides available and how should they be applied?

Pesticides are either liquid or dry. However, within those two categories, pesticides are found in many forms. For example, aerosol is a liquid form of a pesticide; granular is a dry form of a pesticide. Appropriate application of these chemicals should be directed at different plant parts at specific times in the plant's life cycle. Liquid or dry pesticides are diluted with water in specific ratios. AS 6.5 allows the student to practice calculating pesticide dilution formulas.

A. Forms of pesticides

- 1. Liquid
 - a. Aerosols
 - i. Denoted by A on label
 - ii. Pressured cans or aerosol bombs
 - b. Emulsifiable concentrates
 - i. Denoted by EC on label
 - ii. Mixed with water in spray tank
 - c. Encapsulated
 - i. Pesticide sealed in microcapsules
 - ii. Time release
 - iii. Mixed with water
 - d. Flowable
 - i. Denoted by F or L on label
 - ii. Mixed with water
- 2. Dry
 - a. Bait
 - i. Denoted by B on label
 - ii. Pesticide-laden substance that lures pests
 - b. Dust
 - i. Denoted by D on label
 - ii. Pesticide and inert ingredients ground into dust
 - iii. Applied dry
 - c. Granular
 - i. Denoted by G on label
 - ii. Same composition as dust but larger particles

- iii. Applied dry
- d. Soluble powder
 - i. Denoted by S or SP on label
 - ii. Dissolved in water
- e. Wettable powder
 - i. Denoted by W or WP on label
 - ii. Mixed with water in spray tank
 - iii. Must be constantly agitated to keep mixed
- f. Dry flowable
 - i. Dry granules of pesticide
 - ii. Less dust than powders
- B. Application methods
 - 1. Seed treatment
 - 2. Growing media treatment
 - 3. Plant wound treatment
 - 4. Foliar treatment
 - 5. Postharvest treatment
- C. Equipment (See TM 6.13.)
 - 1. Sprayers (handheld, hose end, pump, backpack, wheelbarrow)
 - 2. Aerosol generators and foggers
- D. Pesticide application log (See TM 6.14.)
 - 1. Identifies where to apply pesticide, active ingredients, and EPA registration number
 - 2. Identifies date of application and safe reentry date
 - 3. Enumerates Personal Protection Equipment needed

4. What is the mode of action for different types of pesticides?

How does the pesticide kill the pest? Does the pest die upon contact? Is its life cycle disrupted? Discuss this based on knowledge of the pest's life cycle.

- A. Biologics - contain living organisms (viruses, bacteria, fungi) that cause the pest to become diseased and die
- B. Contact pesticides - kill immediately when sprayed directly on pest
- C. Fumigants - poison gases that are breathed or absorbed
- D. Growth regulators - adversely affect development
- E. Herbicides (two types)
 - 1. Nonselective - kills all plants
 - 2. Selective - kills only target weeds
- F. Pheromones
 - 1. Natural chemicals attract pest
 - 2. Lure pest into trap
- G. Protectants - prevent pest from entering or damaging plant
- H. Stomach poison pesticides - kill when eaten or swallowed
- I. Systemics
 - 1. Absorbed by plant; translocated to all parts via vascular system
 - 2. Kill pest when feeding on plant

Greenhouse Operation and Management

5. What basic pesticide safety issues must be understood?

Why are there so many regulations surrounding the use of chemicals on plants? AS 6.6 allows students to research this question.

- A. Chemical pesticides are powerful substances that must be handled with extreme caution.
 - 1. Can be deadly to humans and animals
 - 2. Can contaminate water and food
 - 3. Can pollute the environment
- B. Adhere to all laws and guidelines that govern the use of pesticides. (See study question 10.)
 - 1. Federal
 - 2. State
 - 3. Local
- C. Take all safety measures to protect yourself and those around you.
- D. Worker Protection Standard was issued by the U.S. Environmental Protection Agency (EPA).
 - 1. Information provided on exposure to pesticides
 - a. Pesticide safety training
 - b. Safety poster on pesticides
 - c. Access to labeling information for handlers and early-entry workers
 - d. Access to specific information on pesticides used on-site.
 - 2. Protection against exposure provided
 - a. Prohibits handlers from contaminating others with pesticides
 - b. Notifies workers of treatment areas to avoid inadvertent exposure
 - c. Requires monitoring during handling tasks to ensure safety of handlers
 - 3. Means to alleviate exposure available
 - a. Provides decontamination sites
 - b. Provides emergency assistance to worker or handler poisoned or injured by a pesticide

6. What are general procedures for pesticide storage and disposal?

Dovetailing on the discussion of the last question, inquire again why there are so many safety procedures. What are potential consequences of not following guidelines on the label?

- A. Pesticide storage
 - 1. Read and follow label for storage instructions.
 - 2. Be aware of general pesticide storage safety guidelines.
 - a. Store in original containers.
 - i. Make sure labels are visible.
 - ii. Indicate the date of purchase.
 - b. Do not store near food, medicine, or other supplies.
 - c. Keep away from flammable materials.
 - d. Routinely check for leaks or damage.
 - e. Keep cleanup materials close by.
 - f. Properly dispose of old or unwanted products.

- B. Pesticide and pesticide container disposal
 1. Read and follow label's precautions and instructions regarding proper disposal.
 2. Be aware of general pesticide disposal guidelines.
 - a. Do not dispose of pesticides down drains, into sewers, or down waterways.
 - b. Follow guidelines for pesticides and pesticide container disposal as mandated by the U.S. Department of Agriculture (USDA) and the EPA.
 - c. Contact the state Department of Natural Resources for specific pesticide laws and guidelines.

7. What personal protection measures are essential when applying pesticides?

Ask students to justify why personal protection is important when using pesticides. If possible, invite an agriculture Extension agent to the classroom to discuss safety and pesticides.

- A. Obtain proper education and permits for pesticide use.
- B. Wear the recommended Personal Protective Equipment (PPE), which may consist of any or all of the following items.
 1. Goggles
 2. Respirator
 3. Long sleeves rolled over long rubber gloves
 4. Hat
 5. Rubber boots
 6. Overalls or coveralls secured with a band over boots
- C. Follow general application safety guidelines.
 1. Select the safest, least toxic substance possible.
 2. Use only approved products and use only for intended purpose.
 3. Use the proper equipment and clothing.
 4. Review label carefully.
 - a. Know and follow proper application procedures.
 - b. Know what to do in case of an accident.
 5. Mix only the amount needed.
 6. Do not eat, drink, or chew anything during or after application until hands are thoroughly washed with cleanser and water.
 7. Be aware of the environment in which application takes place.
 - a. Need adequate ventilation
 - b. Clear area of people, animals, and items
 8. Apply with extreme caution.
 9. Clean all equipment and clothing.
 10. Thoroughly wash skin with cleanser and water.

8. What are the appropriate steps to take in case of accidental pesticide poisoning?

It is important to have the pesticide container nearby during application in case of an accident. The label provides important information to medical personnel.

- A. Observe victim for symptoms.

Greenhouse Operation and Management

1. Symptoms vary depending on the following:
 - a. Type and amount of pesticide
 - b. Length of exposure
 - c. Time interval between exposures
 - d. Victim's general state of health
 2. There are two basic categories of pesticide poisoning.
 - a. External irritants
 - i. Pesticide comes in contact with external tissues.
 - ii. Symptoms may include stinging of eyes, ears, throat, nose, mouth, or other external tissues.
 - b. Internal poisons
 - i. Pesticide is taken into the body through mouth or skin.
 - ii. This may result in injury to internal body organs.
- B. Know and follow first aid procedures.
1. Act as quickly as possible.
 2. Remove victim from contaminated area.
 3. Remove contaminated clothing from the victim.
 4. Generously flood affected area with water.
 5. Contact a doctor or the poison control center.
 6. Administer first aid as directed by doctor or poison control center.

9. Where can greenhouse owners find up-to-date pesticide information and recommendations?

Ask students where they think timely data could be found about pesticides and recommendations for use.

- A. University Extension offices
- B. Department of Agriculture (federal and state)
- C. Pesticide suppliers

10. What certifications are required to use pesticides?

The state of Missouri requires that anyone who applies pesticides in a commercial setting must have a license. The training includes information on protective equipment and personal safety. The following applies to those working in the state of Missouri. Information on reciprocity with surrounding states is also included.

- A. Types of certified applicators and operators
 1. Certified Commercial Applicators
 2. Certified Noncommercial Applicators
 3. Certified Public Operators (government employees)
 4. Certified Private Applicator Licenses
 5. Pesticide Technician Licenses
 6. Pesticide Dealer Licenses
- B. Process for obtaining certification

Greenhouse Operation and Management

1. For Certified Commercial Applicators, Certified Noncommercial Applicators, and Certified Public Operators (government employees):
 - a. Must pass state pesticide certification examinations, General Standards of Competence (CORE) examination, and at least one of the category examinations
 - b. Must submit a completed Certified Applicator and Pesticide Dealer Application to the Bureau of Pesticide Control to reserve time for taking the certification examinations
 - c. Can purchase study manuals from the University of Missouri Extension Publications office by mailing in a completed manual order form or by calling 800-292-0969
 - d. After passing the required exams and depending on the type of license for which the applicant is applying, need to check with the Bureau of Pesticide Control for further details
 2. For Certified Private Applicators:
 - a. Complete Certified Private Applicator Training Program (sponsored by University of Missouri Cooperative Extension Service)
 - b. Complete Private Applicator Certification Training Verification Form
- C. Certification expiration and recertification
1. Certified Commercial Applicator licenses expire annually. The license may be renewed by submitting the license fee and the signed renewal card before expiration. (As of 2002, the fee is \$50; contact the Bureau of Pesticide Control for changes.)
 2. Certified Noncommercial Applicator licenses expire annually. The license may be renewed by submitting the license fee and the signed renewal card before expiration. (As of 2002, the fee is \$25; contact the Bureau of Pesticide Control for changes.)
 3. Certified Public Operator licenses expire every 3 years and may be renewed by submitting the signed renewal card (no license fee is charged).
 4. Certified Private Applicator licenses expire 5 years from issue date. License and certification may be renewed by completing recertification training at the local county Extension office.
 5. All Certified Applicators and Operators are required by state law to renew their certification every 3 years.
 - a. This may be accomplished by attending an approved recertification program or by reexamination.
 - b. The University of Missouri Cooperative Extension Service provides recertification training annually during January. Other groups, businesses, and associations also sponsor recertification training programs.
 - c. The Missouri Department of Agriculture Bureau of Pesticide Control must approve all recertification training programs before awarding recertification credit to those who attend.
 - d. Guidelines for pesticide recertification training programs may be obtained by contacting the Bureau of Pesticide Control.
- D. Contact information:
Missouri Department of Agriculture Bureau of Pesticide Control
Plant Industries Division
The Bureau of Pesticide Control
P.O. Box 630
Jefferson City, MO 65102
Phone: 573-751-5504

Greenhouse Operation and Management

Fax: 573-751-0005

E. Reciprocal states

1. Reciprocity allows an applicant to apply for a Missouri license based on applicant's certification in another state without having to take and pass the Missouri certification examinations.
2. The Missouri Department of Agriculture has entered into formal reciprocal agreements with the following states:
 - a. Agricultural Aviation Board of Mississippi - Categories 1A, 2, 5, and 6
 - b. Arkansas - all categories except for ornamental and turf pest control and the structural pest control categories
 - c. Illinois - all categories administered by the Illinois Department of Agriculture (no agreement with the Illinois Department of Public Health)
 - d. Iowa - all categories
 - e. Kansas - all categories
 - f. Louisiana - all categories except for the structural pest control categories
 - g. Nebraska - all categories

F. Other Activities and Strategies

1. Have students obtain applications for state certification for Commercial Applicator. If they were actually taking the exam, what information would they need to know? Where is the nearest test site? When is the next test date?
2. Invite an agriculture Extension agent to discuss pesticide safety. Topics that may be of interest include least toxic pesticide controls, biopesticides, and insect growth regulators.
3. Show the class any of the following videos, available from CATER (Career & Technical Education Resources), 2 London Hall, University of Missouri-Columbia: *Pesticide Safety in the Greenhouse (AG V90)*, *Part I: Minimal Risk for Pesticide Applicator (AG V233)*, *Part II: Minimal Risk to the Environment (AG V234)*.

G. Conclusion

Understanding the contents of a pesticide label, applying the chemicals, and knowing what safety precautions to take are critical factors in managing pesticides in the greenhouse.

H. Answers to Activity Sheets

AS 6.5 Pesticide Dilution Ratios

1. 1.1 lb
2. 35%
3. 2.4 lb
4. 7 gal.
5. 20%
6. 5.2 gal.

AS 6.6 Pesticide Update

Instructor's discretion

I. Answers to Assessment

1. A
2. A
3. D
4. D
5. C
6. D
7. E
8. B
9. G
10. C
11. F
12. A
13. A. External irritants
B. Internal poisons
14. A. Human and animal fatality
B. Contaminated water and food
C. Polluted environment
15. A. Caution - slight toxicity
B. Warning - slightly toxic
C. Danger or Danger - Poison - highly toxic
16. The student may list any four of the following:
A. Goggles
B. Respirator
C. Long sleeves rolled over long rubber gloves
D. Hat
E. Rubber boots
F. Overalls
G. Coveralls secured with band over boots
17. A. The Environmental Protection Agency B. Federal government
18. A. Information on pesticide exposure
B. Protection against exposure
C. Means to mitigate exposure

UNIT VI: PLANT HEALTH

Name _____

Lesson 3: Pesticide Use and Safety

Date _____

ASSESSMENT

Multiple Choice: Circle the letter of the best answer.

1. How often must all Certified Applicators and Operators renew their certification?
 - A. Every 3 years
 - B. 5 years for issue date
 - C. Annually
 - D. Every 2 years
2. Who mandates the disposal of pesticides?
 - A. USDA and the EPA
 - B. USDA and the State Department of Agriculture
 - C. State Department of Natural Resources and Conservation and USDA
 - D. State Department of Agriculture and the EPA
3. What information does a pesticide label contain?
 - A. LD₅₀ test animal, storage directions, and intended use
 - B. Restrictions, ingredient statement, and price
 - C. Poison control center's telephone number, hazards, and toxicity to other plants and animals
 - D. EPA classification, first aid recommendations, and signal words
4. Who can provide a greenhouse operator with the most current information and recommendations on pesticides?
 - A. University Extension offices, the EPA, and Department of Natural Resources
 - B. Department of Agriculture (federal and state), Department of Conservation, and university Extension office
 - C. Pesticide retailers, the EPA, and Department of Agriculture (federal and state)
 - D. University Extension office, pesticide retailers, and Department of Agriculture (federal and state)

Greenhouse Operation and Management

5. What type of pesticide is made up of aerosols, emulsifiable concentrates, and flowable forms?
- A. Dry
 - B. Gel
 - C. Liquid
 - D. Semisolid

Match the type of pesticide on the left with the method of damage done to pests on the right. Write the letter in the space provided.

- | | |
|-------------------------|--------------------------------|
| _____6. Biologics | A. Kills when swallowed |
| _____7. Contact | B. Kills when inhaled |
| _____8. Fumigant | C. Lures pests to traps |
| _____9. Growth hormones | D. Living organisms kill pests |
| _____10. Pheromones | E. Kills pests directly |
| _____11. Protectants | F. Prevents pests' entry |
| _____12. Stomach | G. Disrupts pests' development |

Short-Answer Questions: Write the answers in the space provided.

13. What are the two basic categories of pesticide poisoning?

- A.
- B.

14. What are three consequences of improper pesticide use?

- A.
- B.
- C.

Greenhouse Operation and Management

15. What are the three signal words that may appear on a pesticide? What is the toxicity level of each signal word?

Signal Word

Toxicity Level

A.

A.

B.

B.

C.

C.

16. Each label recommends Personal Protective Equipment. What are four items that might be required when applying pesticide?

A.

B.

C.

D.

17. A. What agency issued the Worker Protection Standard?

B. Is it a local, state or federal entity?

18. What are the three main elements of the Worker Protection Standard?

A.

B.

C.

Sample Pesticide Label

TM 6.12

7. RESTRICTED USE PESTICIDE
(GROUND AND SURFACE WATER CONCERNS)
FOR RETAIL SALE AND USE ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION, AND ONLY FOR THOSE USES COVERED BY THE CERTIFIED APPLICATOR'S CERTIFICATION.

8. Bug-B-Ded Insecticide
14. 6EC

9. Active Ingredient:
Killazine (2, 4, 6 diamizine) 37.4%
Inert ingredients: 62.6%
Total: 100.0%
1 gal. contains 6.0 lb. killazine
10. 2.5 GALLONS
U.S. Standard Measure
11. EPA Reg. No 100-358
12. EPA Est. 34704-MI-1
3. Statement of Practical Treatment
If swallowed, DO NOT induce vomiting. Call a physician or Poison Control Center immediately.
If in eyes, flush with plenty of water.
If on skin, wash with plenty of soap and water.
NOTE TO PHYSICIAN: vomiting should only be induced under professional supervision.

17. Directions for Use
It is a violation of federal law to use this product in a manner inconsistent with its labeling.

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170.
Do not enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 4 hours. PPE is required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water is:
• Coveralls • Waterproof gloves • Shoes plus socks

Cool-season turf: Chinch bugs, fleas and mole crickets: apply 1 ounce of product per 1000 square feet.
Warm-season turf: White grubs: apply 2 ounces product per 1000 sq. ft. and water in with supplemental irrigation. Allow at least 10 days before making a second application.

1. Keep out of the reach of children
2. CAUTION
4. Harmful if swallowed or absorbed through the skin. Causes minor skin irritation.

5. Personal Protective Equipment (PPE):

Applicators and other handlers must wear:

- Long sleeved shirts
- Chemical resistant gloves
- Shoes plus socks

6. Environmental Hazards
This product is toxic to fish. Do not apply directly to water or to areas where surface water is present.

15. Physical or Chemical Hazards
Do not use or store near heat or open flame.

18. Storage and Disposal
Storage: Do not contaminate water, food, or feed by storage or disposal. Store at temperatures above 32°F.
Pesticide Disposal: Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.
Container Disposal: Triple rinse (or equivalent). Then puncture container and dispose of in a sanitary landfill or incinerate.

16. Limited Warranty and Disclaimer:
The manufacturer warrants that this product conforms to the chemical description on the label; that this product is reasonably fit for the purposes set forth in the directions; that the directions, warnings, and other statements on this label are based upon responsible experts' evaluation of reasonable tests of effectiveness, of toxicity to laboratory animals, and to plants, and of residues on food crops and upon reports of field experience.

13. BUGS-R-US Inc.
1468 North-South Expressway
P.O. Box 5600
Research Triangle Park, NC 123451.

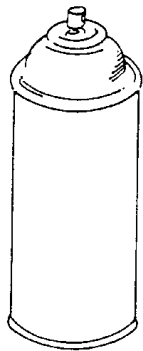
Key to Numbering

<p>1. Child hazard warning. 2. Signal word. 3. Statement of practical treatment 4. Hazards to humans and domestic animals 5. Personal protective equipment 6. Environmental hazards 7. Use classifications 8. Brand (trade) name 9. Ingredient statement</p>	<p>10. Net contents 11. EPA registration number 12. EPA establishment number 13. Name and address of manufacturer 14. Formulation 15. Physical or chemical hazards 16. Limited warranty and disclaimer 17. Directions for use 18. Storage and disposal</p>
---	---

From Fred Fishel and Paul Andre. "Understanding the Pesticide Label." Agricultural publication G1911 - Reprinted December 1, 2001. University of Missouri-Columbia. <<http://muextension.missouri.edu/xplor/agguides/agengin/g01911.htm>> accessed 4/1/02.

Instructor Guide u Page 385

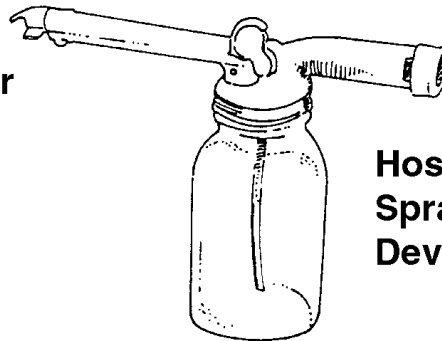
Types of Sprayers Used to Apply Pesticides



**Handheld
Pressurized
Can**

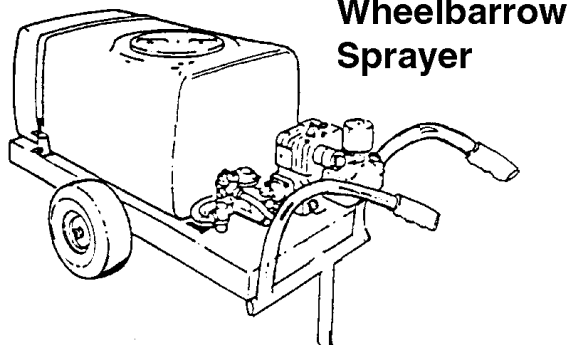
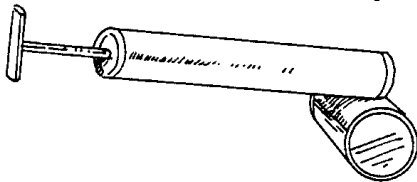


**Trigger
Pump**

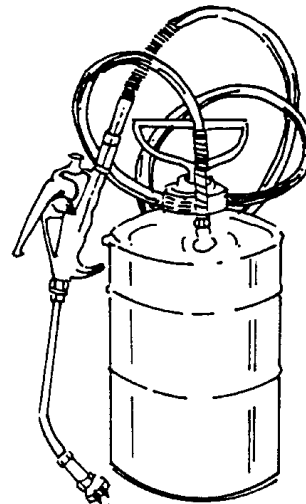


**Hose End
Sprayer
Device**

Push-Pull Pump



**Wheelbarrow
Sprayer**



**Backpack
and
Compressed
Air Sprayer**

Sample Pesticide Application Log

Procedure	Application #1	Application #2
Area Treated: Location & Description		
Product Name		
EPA Registration Number		
Active Ingredient: Common or Chemical Name		
Date of Application: Month/Day/Time		
Entry Restricted Until: Month/Day/time		
Requirement to Post When Area Is Treated? Yes/No		
Requirement to Give Oral Notification? Yes/No		
PPE Requirements for Handlers		
Early Entry PPE Required for Workers		
Other Label Requirements to Protect Workers and Others		

UNIT VI: PLANT HEALTH

AS 6.5

Lesson 3: Pesticide Use and Safety

Name _____

Pesticide Dilution Ratios

Objective: Compute pesticide dilution ratios.

Directions: Use each of the following formulas for dilution ratios to answer the questions. Show all of your work.

Note: 8.3 lb/gal. equals the weight of water.

- To find the number of gallons of emulsifiable concentrate needed to produce a spray of a given percentage of active ingredient:

$$\frac{\text{gallons of spray wanted} \times \text{percent of active ingredient wanted} \times 8.3 \text{ lb/gal.}}{\text{pounds active ingredient per gallon of concentrate} \times 100}$$

- To find the number of pounds of wettable powder needed to produce a spray of a given percentage of active ingredient:

$$\frac{\text{gallons of spray wanted} \times \text{percent of active ingredient wanted} \times 8.3 \text{ lb/gal.}}{\text{percent active ingredient in insecticide product}}$$

- To find the percentage of active ingredient in a mixed product:

$$\frac{\text{pounds of insecticide used} \times \text{percent of active ingredient}}{\text{gallons of mixture} \times 8.3 \text{ lb/gal.}}$$

1. How many pounds of cyromazine 75% wettable powder are needed for 200 gal. of spray solution with .05% cyromazine?
2. Six pounds of bendiocarb in a 50% wettable powder are mixed in 100 gal. of water. What is the percentage of active ingredient in the mixed spray?

Greenhouse Operation and Management

3. How many pounds of cyfluthrin 85% wettable powder are needed for 100 gal. solution with 0.25% cyfluthrin?
4. How many gallons of naled 25% emulsifiable concentrate (1.75 lb naled per gallon) are needed to make 100 gal. of spray with 1.5% naled?
5. Two and a half pounds of carbaryl in a 65% wettable powder are mixed in 100 gal. of water. What is the percentage of active ingredient in the spray mixture?
6. How many gallons of naled 35% emulsifiable concentrate (3 lb naled per gallon) are needed to make 250 gal. of spray with 0.75% naled?

UNIT VI: PLANT HEALTH

AS 6.6

Lesson 3: Pesticide Use and Safety

Name _____

Pesticide Update

Objective: Summarize new information on issues surrounding pesticides in greenhouses.

Directions: Use at least one of the reliable sources listed in the Student Reference. Web sites are acceptable if the information is from a government source, university Extension, or professional journal.

1. What is the name of the source you accessed (e.g., EPA web site)?
2. What are the names of the new chemicals that have been approved for greenhouse use?
3. What is the use of the chemicals (e.g., fungicide for vegetable crops)?
4. Have any chemicals been banned?
5. Which ones?
6. What is the phaseout period?
7. Why the ban?
8. Are there any new biopesticides? Explain.

Greenhouse Operation and Management

9. What is the status of the Food Quality Protection Act of 1996? What are the potential ramifications to greenhouse operators? Has it been amended? If so, how? Has it been repealed?

10. Is there any other new legislation, either national or state, that affects greenhouse operators?