

# ADAP Pesticide Applicator Training

## Instructor's Manual



**ADAP**  
PROJECT

Agricultural Development in the American Pacific  
Pacific Land Grant Programs

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**ADAP Pesticide Applicator Training - Instructor's Manual**

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# ADAP Pesticide Applicator Training

## Instructor's Manual

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The ADAP Project is an equal opportunity employer. All services and information are available to anyone without regard to race, color, religion, sex, age, or national origin.

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## PREFACE

The development of this manual was initiated as a result of a "train-the-trainer" workshop conducted in 1994 by pesticide applicator training personnel from the University of Hawaii and the University of Guam. Workshop funding was provided by the Guam EPA.

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The concept and organization of this manual is substantially based on an instructor's manual developed by Charles Nagamine, Coordinator/Instructor, for two earlier "train-the-trainer" workshops of the Pesticide Applicator Training Program at the College of Tropical Agriculture and Human Resources, University of Hawaii. The workshops were funded by the Governor's Agriculture Coordinating Committee, the Hawaii Farm Bureau, CES/USDA, and the US EPA.

## Checklist For Section One

### HANDOUTS

- Attendance sheet with clipboard
- Lecture schedules
- Survey of Pesticides and Application Equipment Used
- Paraquat, Metholate L, and Agricide labels
- Worker Protection Standards (Enough for 1/3 of those registered)

### SLIDES

- Formulations

### AV EQUIPMENT

- Overhead projector
- Overhead projector marker pens
- Extension cords
- Slide projector remote extension cord
- Adaptors for 3-prong extension cord
- Extra overhead transparencies
- Slide projector

## Introduction and Orientation

### 1. While waiting for late-comers:

**HAND OUT** "Survey of Pesticide and Application Equipment Used." Collect periodically throughout the first few hours.

**HAND OUT** Attendance sheet. Get name and mailing address of everyone.

**EXPLAIN** "The purpose of this training course is to make you a better, more informed pesticide applicator. It will also help you study for the restricted-use pesticide exam."

**HAND OUT** Training schedules. Describe the activities. Explain that everything in this course will be related to pesticide labels.

### 2. Begin lecture: *Introduction and Orientation*

**DEFINE** The terms 'pest' and "pesticide". See p. 2.

**EXPLAIN** That there are different types of pesticides. See p. 3.

**EXPLAIN** The difference between restricted-use pesticides and general-use pesticides. See p. 4.

**EXPLAIN** The categories of restricted-use pesticide permits. See p. 5.

**CONDUCT** Practice exam for 40 minutes. "The purpose of this exam is to find out how much you learn in this training course. There will be a similar exam at the end of the course. We will compare the 'before' and 'after' scores to find out if we are getting the message to you. Please give only your answers. Your exam scores do not go into the DOA's records."

**EXPLAIN** CORE study material corresponds to CORE exam. CATEGORY study material corresponds to CATEGORY exam.

**EXPLAIN** The certification process. "Upon passing the examination you will receive a permit valid for five years. If you wish to be recertified without having to be retested, you must take seventeen hours of related course credits to maintain a private license. You must take thirty-five hours to maintain a commercial license. These regulations are subject to change."

## Laws and Regulations

- HANDOUT** One Metholate L label to each person.
- EXPLAIN** U.S. federal laws that regulate pesticides use. See pp. 33-35.
- EXPLAIN** By passing FEPCA, Congress authorized EPA to protect and the environment from "unreasonable adverse effects" of pesticides. See p. 35.
- EXPLAIN** "Residue" and "tolerance" are related but are not the same. See p. 36.
- EXPLAIN** Federal, State and County agencies regulate different aspects of pesticides. See p. 37. (flow chart)
- EXPLAIN** Record-keeping requirement for commercial applicators. See p. 38.
- EXPLAIN** The sample forms are only examples. You are not required to use these specific form. Records may be kept in a notebook, a folder, or any other form as long as all the items a-k on p. 38 are listed for every job site. In addition to being a legal requirement for commercial applicators, record-keeping is useful to any applicator. It helps determine what pesticides do a good job and it assists drift complaint investigators.
- EXPLAIN** Summary of Worker Protection Standards for Agricultural Pesticides. See pp. 41-42.
- ADVISE** Applicators of category 1a, 10, and 11 to read handout for details. Applicators in other categories may apply some of the regulations to their employees even if they are not legally required to do so.

## Labels and Labeling

- EXPLAIN** Definitions of "label" (which is on or attached to the pesticide's container) and "labeling" (which includes brochures and other notices not attached to the pesticide's container). See p. 44.
- EXPLAIN** Importance of labels. Emphasize that "A pesticide label is a list of the legal (registered) uses and the precautions you need to take." If the crop of site you are going to treat is not listed on your pesticide label, using the pesticide on that crop or site is an illegal (unregistered) use." See p. 45.  
Optional: Situation and Question for Discussion. See p. 46.
- EXPLAIN** Types of labeling. Each pesticide container has instructions listed on the label attached to the container. Some pesticides have additional instructions that are not listed on the container's label. They are listed on separate sheets of paper called supplemental labels. See p. 47.
- EXPLAIN** "Parts of a standardized label." See pp. 48-52.
- EXPLAIN** "The Misuse Statement." See p. 57.
- EXPLAIN** "Label Interpretation." See p. 58. "You don't have to follow label directions exactly. Here are 6 things that you can do differently."
- EXPLAIN** "Pesticide Formulations." See pp. 59-64.
- EXPLAIN** Sample directions from different labels showing the same ingredient in different formulations. See p. 63.  
"Here are parts of two different Diazinon labels. Notice the phrase 'SUCH AS' on the first set of label directions. This means you may use Diazinon 50W to treat the plants listed as well as other ornamentals not listed. This interpretation should not be applied to food or feed crops. Notice in the second set of label directions that the phrase 'SUCH AS' is not there. This means you may not use Diazinon AG 500 for ornamental plants which are not listed."



**SECTION 1:  
LAWS AND REGULATIONS**

**Introduction**

**Definitions**

**Restricted Use Pesticides**

**Practice Exam**

**Pesticide Laws**

**Record Keeping**

**Worker Protection Standards**

**Labels and Labelling**

**The Misuse Statement**

**Pesticide Formulations**

## Pest and Pesticide Definitions

1. Pest: Any living organism not wanted by humans because it consumes a resource such as a crop.
  
2. Pesticide
  - a. Any substance or mixture of substances intended for use in preventing, destroying, repelling, or reducing the impact of any pest.
  
  - b. Any substance or mixture of substances intended for use as a plant growth regulator, defoliant, or desiccant.

## Types of Pesticides

1. Insecticides
2. Miticides
3. Nematicides
4. Fungicides
5. Bactericides
6. Algicides
7. Rodenticides (Rat/Mouse baits)
8. Molluscicides (Snail/Slug baits)
9. Plant Growth Regulators
10. Insect Growth Regulators
11. Desiccants
12. Herbicides

The following are not pesticides:

Surfactants

Fertilizers

Animal drugs

## Differences Between Restricted-Use and General-Use Pesticides

1. Toxicity refers to how poisonous a pesticide is to living organisms.
  
2. Restricted-use pesticides
  - a. Moderate to high toxicity to people or the environment.
  - b. A permit is required to buy and use them.
  - c. Examples: Gramoxone® and Lannate®.
  
3. General-use (Non-restricted) pesticides
  - a. Low to moderate toxicity to people or the environment.
  - b. A permit is not required to buy and use them.
  - c. Examples: Mosquito coils and cockroach sprays.

## Types of Restricted-Use Permits

1. Private applicator permit: For applying pesticides when producing agricultural commodities such as fruits, vegetables, livestock, and ornamental plants.
  
2. Commercial applicator permit
  - a. Any use other than those listed for private applicators.
    - i. 'For hire' agricultural uses
    - ii. Non-agricultural uses
  - b. Types of U.S. federal commercial categories
    - i. Agricultural plants or animals
    - ii. Forest
    - iii. Ornamental and turf
    - iv. Seed treatment
    - v. Aquatic
    - vi. Right-of-way
    - vii. Industrial, institutional, structural, or health related
    - viii. Public health
    - ix. Regulatory
    - x. Demonstration and research
    - xi. Aerial

TODAY'S DATE \_\_\_\_\_

NAME \_\_\_\_\_

## Practice Exam: Part A

**INSTRUCTIONS:** Use your own knowledge, a calculator, and the three sample labels provided by the instructor to answer the following questions. Please do not use notes, otherwise we will not be able to accurately measure how much you have learned in this training course. For each multiple-choice question, choose the best answer.

1. Metholate L is a restricted-use pesticide. This means that it can be used only by certified applicators or persons under their "direct supervision". "Direct supervision" means that the certified applicator must:
  - a) constantly watch the uncertified applicator who is applying the restricted-use pesticide.
  - b) give written instructions and be available when and if needed.
  - c) be with the uncertified applicator who is applying the restricted-use pesticide.
  - d) be on the site while the uncertified applicator is applying the restricted-use pesticide.
  
2. The following statement, "It is a violation of federal law to use this product in a manner inconsistent with its labeling." is called the:
  - a) misuse statement.
  - b) regulatory quotation.
  - c) statement of legal sanction.
  - d) standard authorized warning.
  
3. What is the common name for Metholate L?

**Methomyl**

4. What is the signal word for Metholate L?

**Danger**

5. Metholate L's relative toxicity to people is:
- high.
  - moderate.
  - slight; low.
  - zero; non-toxic.
6. When a signal word is assigned to a pesticide, the decision is based on:
- the pesticide's effectiveness against the target pests named on the label.
  - the pesticide's hazard to beneficial insects and other non-target organisms.
  - the pesticide's oral, dermal and inhalation toxicity and its eye and skin irritation ratings.
  - the pesticide's chemical reactivity to plastic, fiberglass and resins, neoprene, vinyl and other synthetic materials used to make pesticide application equipment.
7. Mixing and loading is considered the most hazardous job when handling pesticides. This is because:
- studies show that people often don't wear gloves when mixing and loading.
  - of the explosion hazard of wrong mixing methods.
  - this is when pesticides are the most concentrated.
  - chemical cartridge respirators will not filter out fumes of concentrated (undiluted) pesticides.
8. What is the first action you should take if you have spilled Metholate L on your bare hands?  
**Wash with plenty of soap and water.**
9. What signs and symptoms of poisoning should you look for in a person exposed to Metholate L?
- |                         |                            |                 |                   |
|-------------------------|----------------------------|-----------------|-------------------|
| <b>Weakness</b>         | <b>Blurred Vision</b>      | <b>Headache</b> | <b>Nausea</b>     |
| <b>Abdominal Cramps</b> | <b>Discomfort in Chest</b> | <b>Sweating</b> | <b>Slow Pulse</b> |
| <b>Muscle Tremors</b>   | <b>Constricted Pupils</b>  |                 |                   |
10. Suppose someone swallowed some pesticide and you are advised to make the person vomit. Briefly describe two methods of inducing vomiting.
- Administer syrup (tincture) of IPECAC.**
  - Touch back of victim's throat with clean, smooth, blunt object or finger.**
11. If you must take a poisoning victim to a hospital or a doctor, what important item should you also take along?  
**The pesticide label.**

12. If pesticide splashes in your eye, how long should you rinse out your eye with water?

15 minutes

13. What type of formulation is Agricide?

Wettable Powder (WP)

14. The "pre-harvest" interval refers to the period of time between:

- a) the last pesticide application and harvesting of a food crop.
- b) planting and harvesting of a food crop.
- c) last fertilizer application and harvesting of a food crop.
- d) the half-ripe stage and the harvesting stage of a fruit crop.

15. Name 6 symptoms you may experience if you are poisoned by an organophosphate insecticide.

Mild Poisoning

fatigue

headache

constriction

dizziness

secretions

blurred vision

excess sweat and saliva

nausea and vomiting

stomach cramps or diarrhea

Moderate Poisoning

unable to walk

weakness

chest discomfort

muscle twitches

constriction of pupils

severe earlier symptoms

Severe Poisoning

unconsciousness

severe pupil

mouth and nose

muscle twitches

difficult breathing

death if not treated

16. What information does the "re-entry statement" on a pesticide label give?

How long an unprotected field worker must stay out of treated area or how soon a field worker can reenter treated area without protective clothing.

17. "Calibration of your sprayer" means:

- a) knowing and adjusting the amount of mixture your sprayer will spray on an area; for example gallons per acre or gallons per 1,000 square feet.
- b) marking your sprayer tank or a dip-stick with your own lines to show the level of spray mixture in the tank; for example, lines for each 1 gallon or for each 5 gallons.
- c) calculating how fast the sprayer must move across the area you are treating in order to apply the desired amount of pesticide on the area; for example, 2 miles per hour.
- d) finding out, by trial and error, the correct amount of pesticide and water to mix together in the sprayer tank in order to get effective pest control.



18. Complete the following:

$$1 \text{ pound} = \underline{16} \text{ ounces}$$

$$1 \text{ gallon} = \underline{4} \text{ quarts}$$

$$1 \text{ quart} = \underline{2} \text{ pints}$$

$$1 \text{ pint} = \underline{2} \text{ cups}$$

$$1 \text{ cup} = \underline{8} \text{ fluid ounces}$$

$$1 \text{ acre} = \underline{43560} \text{ square feet}$$

$$1 \text{ minute} = \underline{60} \text{ seconds}$$

19. Suppose you want to use AGRICIDE to control gray mold on your tomato plants growing in a greenhouse. Your sprayer tank can hold only 40 gallons of spray mixture. How much Agricide should you weigh out to make one full tank of spray mixture?

3.2 ounce(s) up to 6.4 ounce(s).

From the AGRICIDE label: For tomatoes use 1/2 to 1 lb. per 100 gallons of water.

$$\frac{1 \text{ lb. AGRICIDE}}{100 \text{ gal. water}} = \frac{X}{40 \text{ gal. water}}$$

$$X = \frac{1 \text{ lb. AGRICIDE} \times 40 \text{ gal. water}}{100 \text{ gal. water}}$$

$$X = \frac{40 \text{ lb. AGRICIDE}}{100}$$

$$X = 0.4 \text{ lb AGRICIDE}$$

$$0.4 \text{ lb} \times 16 \text{ oz./lb.} = \underline{6.4 \text{ ounces}}$$

For 1/2 lb. the amount of AGRICIDE required is 1/2 as much or **3.2 ounces**.

20. Suppose it takes you 32 seconds (average) to spray 100 square feet of a field of cucumber with METHOLATE L. How long would it take you to spray 1 acre of the same field of cucumber?

232.32 minute(s)/acre

SHOW HOW YOU GOT YOUR ANSWER.

$$\frac{43560 \text{ sq. feet}}{1 \text{ acre}} \times \frac{32 \text{ seconds}}{100 \text{ sq. feet}} \times \frac{1 \text{ minute}}{60 \text{ seconds}} = \underline{232.32 \text{ minutes/acre}}$$

21. Suppose the sprayer you are using to treat your field of cucumber is calibrated to spray out 36 fl. oz. of spray mixture (average) in 15 seconds. How much spray mixture would be sprayed out in 1 minute?

1.125 gallon(s)/minute

SHOW HOW YOU GOT YOUR ANSWER.

$$\frac{36 \text{ ounces}}{15 \text{ seconds}} \times \frac{60 \text{ seconds}}{1 \text{ minute}} \times \frac{1 \text{ gallon}}{128 \text{ ounces}} = \underline{1.125 \text{ gallons/minute}}$$

22. REFER TO QUESTIONS #20 AND #21. How much spray mixture would you use to treat 1 acre of your cucumber field?

261 gallon(s)/acre

SHOW HOW YOU GOT YOUR ANSWER.

$$\frac{232 \text{ minutes}}{1 \text{ acre}} \times \frac{1.125 \text{ gallons}}{1 \text{ minute}} = \underline{261 \text{ gallons/acre}}$$

23. (This question is separate from questions 20, 21, and 22.) Suppose you calibrated your sprayer to apply 70 gallons of spray mixture per acre. The sprayer you are using to treat your cucumber field can hold 100 gallons of spray mixture. What is the maximum amount of METHOLATE L you should measure out to make one full tank of spray mixture?

11 cup(s) + 3.4 fl. oz./100 gallon tank

SHOW HOW YOU GOT YOUR ANSWER.

From the METHOLATE L label, the rate is 4 pints/acre and it takes 70 gallons of spray mixture per acre:

$$\frac{4 \text{ pints}}{70 \text{ gal}} = \frac{X}{100 \text{ gal.}}$$

$$X = \frac{4 \text{ pints} \times 100 \text{ gal.}}{70 \text{ gal.}}$$

$$X = \frac{400 \text{ pints}}{70}$$

$$X = 5.71 \text{ pints}$$

$$5.71 \text{ pints} \times 2 \text{ cups/pint} = 11.43 \text{ cups} = \underline{11 \text{ cups} + 3.4 \text{ ounces.}}$$

FICTITIOUS LABEL. FOR CLASSROOM USE ONLY.

RESTRICTED USE PESTICIDE

For retail sale to and use only by Certified Applicators or persons under their direct supervision and only for those uses covered by the Certified Applicator certification.

LIDCAR

METHOLATE L

Water Soluble Liquid

1 gallon contains 1.8 lbs. of Methomyl

ACTIVE INGREDIENT: Methomyl]

S-methyl N-[(methylcarbamoyl)oxy]thioacetimidate .....24%

INERT INGREDIENTS .....76%

EPA Reg. No. 587-201

EPA Est. 587-VA-1

KEEP OUT OF REACH OF CHILDREN

DANGER



POISON

STATEMENT OF PRACTICAL TREATMENT

If swallowed: Call a physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. Do not induce vomiting or give anything by mouth to an unconscious person.

If inhaled: Remove from exposure and have patient lie down and keep quiet. If patient is not breathing, start artificial respiration immediately. Never give anything by mouth to an unconscious person.

In case of contact: Wash skin with plenty of soap and water; for eyes, flush with water for 15 minutes and get medical attention; remove and wash contaminated clothing before re-use.

ATROPINE IS AN ANTIDOTE. SEEK MEDICAL ATTENTION AT ONCE IN ALL CASES OF SUSPECTED POISONING.

If warning symptoms appear, get medical attention. See WARNING SYMPTOMS on next page.

See next page for PRECAUTIONARY STATEMENTS.

1 U.S. GALLON

DO NOT SUBJECT TO TEMPERATURES BELOW 32° F.

Lidcar (Inc.)

AGRICHEMICALS DIVISION, ALBANY, NEW YORK

**PRECAUTIONARY STATEMENTS  
HAZARDS TO HUMANS AND DOMESTIC ANIMALS**

**DANGER****POISON**

**CONTAINS METHANOL. MAY BE FATAL OR CAUSE BLINDNESS IF SWALLOWED.  
POISONOUS IF INHALED. CAUSES EYE DAMAGE.**

**Do not breathe vapors or spray mist. Do not get in eyes, on skin, or on clothing.**

**WARNING SYMPTOMS:** Methomyl poisoning produces effects associated with anticholinesterase activity which may include weakness, blurred vision, headache, nausea, abdominal cramps, discomfort in the chest, constriction of pupils, sweating, slow pulse, muscle tremors.

**NOTE TO PHYSICIAN**

**TREATMENT:** Atropine sulphate should be used for treatment. Administer repeated doses, 1.2 to 2.0 mg. intravenously every 10 to 30 minutes until full atropinization is achieved. Maintain atropinization until the patient recovers. Artificial respiration or oxygen may be necessary. Allow no further exposure to Metholate L alone. However, for exposure to combination of Metholate L and organophosphorous insecticides, 2-PAM may be used as required to supplement the atropine sulfate treatment. Do not use morphine.

**ENVIRONMENTAL HAZARDS**

This product is toxic to fish, birds, and other wildlife. Keep out of any body of water. Do not apply where runoff is likely to occur. Do not apply when weather conditions favor drift from areas treated. Do not contaminate water by cleaning of equipment or disposal of wastes. This product is toxic to bees exposed to direct application. Do not apply this product while bees are actively visiting the treatment area. Time applications to coincide with periods of minimum bee activity.

**PHYSICAL AND CHEMICAL HAZARDS**

Flammable. Keep away from heat, sparks, and open flame. Keep container closed. Use with adequate ventilation.

**STORAGE AND DISPOSAL**

Pesticide, spray mixture or rinse water that cannot be used according to label instructions must be disposed of according to Federal or approved state procedures under Subtitle C of the Resource Conservation and Recovery Act. Triple rinse (or equivalent). Then offer for recycling or reconditioning, or puncture and dispose of in sanitary landfill, or by other approved State and local procedures.

**IMPORTANT**

When mixing spray, loading, applying or otherwise handling, wear protective goggles and a mask or respirator jointly approved by the Mine Safety and Health Administration (formerly the U.S. Bureau of Mine) and by the National Institute for Occupational Safety and Health. Wear clean clothes daily. Wash thoroughly after handling and before eating or smoking. Pilot should not assist in the mixing and loading operation. Keep animals and unprotected persons out of operational areas during treatment and while there is danger of drift. Not for use or storage in or around the home.

**GENERAL INFORMATION**

**Scouting:** Monitoring insect populations to determine whether or not there is a need for application of Metholate L is recommended. More than one treatment of Metholate L may be required to control a population of pests.

**Insect Predators:** Metholate L at rates of 1/2 to 1 pint per acre helps conserve certain beneficials including big-eyed bugs, damsel bugs, flower bugs and spiders in cotton and soybeans. While these benefits cannot be relied upon to control pests, they are of potential value and should be monitored along with pests in pest management programs on these crops.

**Compatibility:** Since formulations may be changed and new ones introduced, it is recommended that users premix a small quantity of a desired tank mix and observe for possible adverse changes (settling out, flocculations, etc.) Avoid mixtures of several materials and very concentrated spray mixtures. Do not use Metholate L with Bordeaux mixture, Du Ter (triphenyltin hydroxide), lime sulfur, Rayplex iron, nor in highly alkaline solutions. Use mildly alkaline mixtures immediately after mixing to prevent loss of insecticidal activity.



**POISON**



**NOTICE OF WARRANTY**

Lidcar warrants that this product conforms to the chemical description of the label thereof and is reasonably fit for the purposes stated on such label only when used in accordance with the directions under normal use conditions. It is impossible to eliminate all risks inherently associated with the use of this product. Crop injury, ineffectiveness, or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application, all of which are beyond the control of Lidcar. In no case shall Lidcar be liable for consequential, special or indirect damages resulting from the use or handling of this product. All such risks shall be assumed by the buyer. LIDCAR MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

**DIRECTIONS FOR USE**

It is a violation of federal law to use this product in a manner inconsistent with its labeling. Lidcar Metholate L should be used only in accordance with recommendations on this label, or in separate published Lidcar recommendations available through local dealers. Lidcar will not be responsible for losses or damages resulting from use of this product or in any manner not specifically recommended by Lidcar. User assumes all risks associated with such non-recommended use. Metholate L is a water soluble liquid to be diluted with water for application by ground or air equipment. Use only in commercial plantings; do not use in home plantings.

**SPRAY PREPARATION:** Fill spray tank 1/4 to 1/2 full of water. Add Metholate L directly to spray tank and mix thoroughly, using mechanical or hydraulic means; do not use air agitation.

**APPLICATION:** Apply at the recommended rates when insects first appear. Unless otherwise noted, continue application at 5-to-7-day intervals or as needed. Use sufficient water to obtain thorough, uniform coverage. Since Metholate L is a fast-acting contact insecticide, best results follow direct spraying of the target insect. This can be accomplished with fine spray droplets at low volume. For aerial, use a minimum of 5 gallons per acre (gpa) except: 2 gpa for beans (including blackeyed peas and cowpeas), cucumber, melons (including cantaloupe and watermelon), peanuts, sorghum and soybeans; 3 gpa for alfalfa, cabbage, corn, cotton, lettuce, onions, peas, spinach, and beets; 10 gpa for grapes, nectarines, and strawberries; 15 gpa for oranges and lemons. Apply the low rates on small plants, small insects and light infestations of insects. Use intermediate rates on large insects and heavier infestations of insects. Use 1 to 3 applications of the highest recommended rate for controlling severe infestations. Thereafter, use the lowest rate possible to maintain control.

Made in U.S.A.

Printed in U.S.A.

**NOTICE TO BUYER**

Purchase of this material does not confer any rights under patents of countries outside the United States.

Crop	Insects	Rate (pints/acre)	Last Application (days)	
			To Harvest	To Grazing
Alfalfa (Do not apply to dormant or semi-dormant alfalfa when min. daily temp. is 50F or lower.)	Pea Aphid, Lygus Bugs, Blotch Leafminer, Aphids, Egyptian Alfalfa Weevil Larvae	2 to 4		
	Fall Armyworm	2		
	Alfalfa Weevil Larvae	4		
	Loopers, Yellowstriped Armyworm, Western Yellowstriped Armyworm, Armyworm	1 to 2		7
	Variiegated Cutworm, Beet Armyworm	1 to 4		
	Alfalfa Caterpillar	1 1/3 to 2		
Anise (Fennel)	Cabbage Looper	4		
	Beet Armyworm	2 to 4	7	
Apple (Do not use on Early Macintosh and Wealthy Varieties.) **G	Apple Aphid	0.5-2/100 gals; up to 400 gals. per acre		
	Rosy Apple Aphid, Tufted Apple Budmoth, Green Fruitworm, Tarnished Plant Bug	1-2/100 gals; up to 400 gals. per acre	8	10
	Codling Moth (10-12 day interval)			
	Leafrollers (Fruittree, Obliquebanded, Redbanded, Variegated), Lesser Appleworm, White Apple Leafhopper, Tentiform Leafminer	2/100 gals; up to 400 gals. per acre		
	Cutworm	2/100 gals.		
Asparagus	Beet Armyworm, Western Yellowstriped Armyworm, Spotted Asparagus Beetle, White Cutworm, Redbacked Cutworm, Variegated Cutworm	2 to 4	1	
		2		
Avocado	Avocado Looper, Avocado Leafroller, Omnivorous Leafroller	2 to 4	1	10
Beans (Includes Blackeyed Peas and Cowpeas)	Leafhopper, Mexican Beetle	1 to 4		
	Fall Armyworm, Variegated Cutworm	2		
	Beet Armyworm, Loopers, Corn Earworm, Saltmarsh Caterpillar, Yellowstriped Armyworm, Western Yellowstriped Armyworm, Lygus Bugs, Thrips, Aphids	2 to 4	Succulent Beans 1 to 2 pts.-1 Over 2 pts.-3	3 Vines 4 Hay
	European Comborer*** - Initiate when moth flights first appear and continue preventive treatments at 3-4 day intervals to control eggs and larvae		Dry Beans-25	
Beets (Table)	Spotted Cucumber Beetle	1 to 2		
	Imported Cabbageworm, Beet Armyworm, Cabbage Looper, Diamond Moth	2 to 4	0-Roots 14-Tops	
Cucumber Beetle, Variegated Cutworm		2		
Bermuda Grass	Fall Armyworm	1 to 4		7 Forage 3 Dehydrated Hay
Broccoli	Looper, Imp. Cabbageworm, Diamondback Moth	1 to 4*	3	

Crop	Insects	Rate (pints/acre)	Last Application (days)	
			To Harvest	To Grazing
Brussel Sprouts	Looper, Imp. Cabbageworm, Diamondback Moth	2 to 4*	3	
	Variegated Cutworm	2*		
Cabbage	Looper, Imported Cabbageworm, Diamondback Moth	1 to 4*	1	
	Fall Armyworm, Variegated Cutworm	2*		
Carrots	Beet Armyworm	1 1/3 to 4	1	
	Aster Leafhopper	2 to 4		
	Armyworms	2		
	Variegated Cutworm	1 to 2		
Cauliflower	Looper, Imp. Cabbageworm, Diamondback Moth	1 to 4*	3	
	Variegated Cutworm	2*		
Celery	Beet Armyworm, Aster Leafhopper	2 to 4	7	
	Loopers	4		
	Variegated Cutworm	2		
	Armyworms	1 to 2		
Chicory	Beet Armyworm, Variegated Cutworm, Leafhoppers	2 to 4	80	
Chinese Cabbage**G	Loopers, Beet Armyworm	2 to 4	10	
Collards (Fresh market only. Do not apply when temp. is less than 50F or crop is less than 10 inches tall.)	Loopers, Diamondback Moth, Variegated Cutworm	2	10	
	Imported Cabbageworm, Beet Armyworm	2 to 4		
Corn (Sweet) Note: Certain hybrids are susceptible to methomyl injury. Test a small area first.	Earworm-Whorl as needed	1 1/3 to 2	0 Ears	3 Forage
	Fall Armyworm, Armyworm, Earworm (Ovicide/Larvicide), European Comborer-Ears 1-3 days or as needed, Corn Rootworm (adult beetles), Flea Beetles, Picnic Beetles, Aphids	1 to 2		
	Variegated Cutworm, Beet Armyworm	2		
Corn (Field and Popcorn)	Earworm, Armyworm, Fall Armyworm, Corn Rootworm (adult beetles), Flea Beetles, Picnic Beetles, Aphids	1 to 2	0 Ears	3 Forage
Cucumber	Loopers, Tobacco Budworm, Beet Armyworm, Yellowstriped Armyworm, Granulate Cutworm, Flea Beetles, Cucumber Beetles, Melon Aphid, Melonworm, Pickleworm	2 to 4	2 pts.-1 Over 2 pts.-3	
	Fall Armyworm, Variegated Cutworm	2		
Eggplant	Green Peach Aphid	1 to 4	5	
	Tomato Pinworm**G	2 to 4		
Forest Woodlots, Plantations, Nurseries**G	Spruce Budworm (treat when larvae are feeding on buds, treat again after 3-4 days if needed)	1 to 2		
	Forest and Western Tent Caterpillars	2 to 4		



Crop	Insects	Rate (pints/acre)	Last Application (days)	
			To Harvest	To Grazing
Garlic	Beet Armyworm	2*	7	
Grapefruit	CA & AZ: Thrips, Fruittree Leafroller, Orange Tortrix, Tussock Moth	2 to 4	1	10
	U.S.: Beet Armyworm			
	FL: Spirea Aphid			
	FL: Whitefly	4		
Grapes	East of Rockies: Grape Berry Moth (apply pre- and post-bloom and repeat at 10-14 day intervals or as needed), Leafhoppers**G	2 to 4	1 Fresh & Raisin	
	U.S.: Omnivorous Leafroller, Grape Leafroller, Orange Tortrix	4		
	West of Rockies: Saltmarsh Caterpillar Leafhoppers**G	2 to 4	14 Wine & Grapes	
	Climbing Cutworm (treat and repeat at 7-14 day intervals as needed)	4		
	CA: Grape Leaf Skeletonizer**G	2 to 4	65	
Leafy Greens: Beet Tops, Dandelion, Kale, Mustard, Parsley, Swiss Chard, Turnip Greens	Beet Armyworm	2 to 4	10	
	Cabbage Looper			
	Diamondback Moth			
	Imported Cabbageworm			
Lemon	CA & AZ: Thrips, Western Tussock, Orange Tortrix	2 to 4	1	10
	U.S.: Beet Armyworm			
	FL: Spirea Aphid			
	FL: Whitefly	4		
Lentils	Western Yellowstriped Armyworm	2 to 4	21	
Lettuce (head varieties in U.S. and leaf varieties in CA and AZ)	Beet Armyworm, Loopers	1 to 4	1 to 2 pts.-7 Over 2 pts.-10	
	Thrips, Aphids, Corn Earworm, Aster Leafhopper	2 to 4		
	Variegated Cutworm	2		
Melons	Loopers, Tobacco Budworm, Beet Armyworm, Yellowstriped Armyworm, Granulate Cutworm, Flea Beetle, Cucumber Beetle, Melon Aphid, Pickleworm	2 to 4	2 pts.-1 Over 2 pts.-3	
	Fall Armyworm, Variegated Armyworm	2		
Mint	Variegated Armyworm, Alfalfa Looper	4	14	
	Flea Beetle	3 to 4		
Onion	Beet Armyworm, Thrips, Variegated Cutworm	2*	Green-28 Dry-7	
Orange	CA & AZ: Thrips, Western Tussock Moth, Orange Tortrix, Fruittree Leafroller, Citrus Cutworm	2 to 4	10	
	U.S.: Beet Armyworm			
	FL: Spirea Aphid			
	FL: Whitefly	4		

Crop	Insects	Rate (pints/acre)	Last Application (days)	
			To Harvest	To Grazing
Ornamentals** See sup. labeling	Bulletin E-40477 1/81 obtainable upon request	1 to 2/ 100 gals.		
Peanuts	Corn Earworm***, Beet Armyworm, Potato Leafhopper-up to 3 applications	1 to 4	21	Do not feed treated vines
	Loopers, Green Cloverworm, Velvetbean Caterpillar, Thrips, Granulate Cutworm-up to 3 applications	2 to 4		
	Fall Armyworm	1 to 2		
Peas (Succulent)	Armyworm, Green Cloverworm	1 to 2	1	5 Forage 14 Hay
	Loopers, Pea Aphid, Beet Armyworm, Saltmarsh Caterpillar, Variegated Cutworm	2 to 4		
	Alfalfa Caterpillar	1 to 4		
Peppers	Green Peach Aphid, Fall Armyworm, Loopers, Beet Armyworm	2	3	
	Armyworm, Variegated Cutworm	1 to 2		
	Omnivorous Leafroller	4		
Pomegranates	Omnivorous Leafroller	4	14	
Potato	Tuberworm, Loopers, Aphids, Beet Armyworm	2 to 4	6	
	Leafhoppers, Variegated Cutworm, Fall Armyworm, Flea Beetles	2		
	Beet Armyworm, Thrips, Aphids	2 to 4		
Strawberry	Lygus Bugs, Omnivorous Leaf Tiers	4	3 Fresh 10 Processed	
	Armyworms	3 to 4	90	
Strawberry (dormant)	Armyworms	3 to 4	90	
	Summer Squash	Loopers, Tobacco Budworm, Beet Armyworm, Yellowstriped Armyworm, Granulate Cutworm, Flea Beetles, Melon Aphid, Melonworm, Pickleworm, Fall Armyworm	2 to 4	2 pts.-1 Over 2 pts.-3
Tangerine	CA & AZ: Thrips, Western Tussock Moth, Orange Tortrix	2 to 4	1	10
	U.S.: Beet Armyworm	4		
	FL: Spirea Aphid, Whitefly	2 to 4		
Tomato	Tomato Fruitworm, Aphids, Hornworm, Loopers, Beet Armyworm, Southern Armyworm	2 to 4	1	
	Pinworm			
	Fall Armyworm, Variegated Cutworm	2		
	Armyworm	1 to 2		
Turf**G	Sod Webform (sprinkle for 15 minutes after application)	4 to 8 (1.5 to 3 fl. oz. per 1000 sq. ft.)		Do not graze or feed
Watercress**G	Beet Armyworm, Cabbage Looper, Diamondback moth, Imported Cabbageworm (Use in min. of 30 gpa of water. Turn off water 24 hours prior to application.)	2 to 4	10	

**FICTITIOUS LABEL.  
FOR CLASSROOM USE ONLY.**

# AGRICIDE

## FUNGICIDE

### WETTABLE POWDER

ACTIVE INGREDIENT	BY WEIGHT
Benomyl [Methyl 1-(butylcarbamoyl)-2-benzimidazolecarbamate] .....	50%
INERT INGREDIENTS .....	50%
TOTAL.....	100%

EPA Reg. No. 123-456

EPA Est. 587-VA-2

### KEEP OUT OF REACH OF CHILDREN

## CAUTION

### PRECAUTIONARY STATEMENTS HAZARDS TO HUMANS AND DOMESTIC ANIMALS

#### CAUTION! MAY IRRITATE EYES, NOSE, THROAT AND SKIN.

Avoid breathing dust or spray mist. Avoid contact with skin, eyes, and clothing.

This product may cause a temporary allergic skin reaction in a few susceptible persons. This condition should be treated as an allergic dermatitis. There is no evidence of after effects or permanent injury.

**First Aid:** In case of contact, flush skin or eyes with plenty of water; for eyes, get medical attention.

**For medical emergencies involving this product, call toll free 1-800-441-3637.**

### PERSONAL PROTECTIVE EQUIPMENT

#### Handlers who may be exposed to the dilute through application or other task must wear:

- Long-sleeved shirt and long pants.
- Waterproof gloves.
- Chemical-resistant footwear plus socks.
- Chemical-resistant apron when cleaning equipment.

#### Handlers who are exposed to the concentrate during mixing, loading, application, or other task must wear:

- Long-sleeved shirt and long pants.
- Waterproof gloves.
- Chemical-resistant footwear plus socks.
- Chemical-resistant apron when mixing or loading.

For exposures in enclosed areas, a respirator with either an organic vapor-removing cartridge with a prefilter approved for pesticides (MSHA/NIOSH approval number prefix TC-23C), or a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G).

For exposures outdoors, a dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C).

Follow manufacturers instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

### ENGINEERING CONTROL STATEMENTS

Human flaggers must be in enclosed cabs. When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR part 170.240 (d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS. The enclosed cabs must be used in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR part 170.240 (d)(4-6)]. The handler PPE requirements may be reduced or modified as specified in the WPS.

### USER SAFETY RECOMMENDATIONS

**USERS SHOULD:** Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet. Remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

### ENVIRONMENTAL HAZARDS

This pesticide is toxic to fish. For terrestrial uses, do not apply directly to water, to areas where surface water is present, or to intertidal areas below the mean high water mark, except for the registered aquatic use on rice. Do not apply where runoff is likely to occur. Drift and runoff from treated areas may be hazardous to fish in adjacent areas. Do not contaminate water when disposing of equipment washwaters. Do not apply when weather conditions favor drift from areas treated. For registered aquatic uses: Aquatic organisms may be killed at recommended application rates.

### PHYSICAL OR CHEMICAL HAZARDS

Keep away from fire or sparks.

### DIRECTIONS FOR USE

It is a violation of federal law to use this product in a manner inconsistent with its labeling. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

**AGRICULTURAL USE REQUIREMENTS:** Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. This Standard contains requirements for the protection of agricultural workers on farms, forests, nurseries, and greenhouses, and handlers of agricultural pesticides. It contains requirements for training, decontamination, notification, and emergency assistance. It also contains specific instructions and exceptions pertaining to the statements on this label about personal protective equipment (PPE) and restricted-entry interval. The Agricultural Use Requirements only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow workers entry into treated areas during the restricted entry interval (REI) of 24 hours. PPE 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.
- Chemical-resistant footwear plus socks.

Lidcar Agricide should be used only in accordance with recommendations on this label, or in separate published Lidcar recommendations available through local dealers. Lidcar will not be responsible for losses or damages resulting from use of this product in any manner not specifically recommended by Lidcar. User assumes all risk associated with such nonrecommended use.

Agricide is a systemic fungicide recommended for the control of many important plant diseases. If treatment is not effective following use of Agricide as recommended, a resistant strain of the fungus may be present. If treatment is ineffective due to the presence of a benomyl resistant strain, then neither Agricide, nor any other benzimidazole or thiophanate type fungicide will effectively control that disease; consideration should be given to prompt use of other types of suitable fungicides.

The repeated exclusive use of Agricide may lead to buildup of resistant strains of fungi and loss of disease control. A spray program using other fungicides may delay resistant strain buildup. Consult your state extension specialist or official state recommendations for guidance on your particular crop and disease control situation.

**NOTE: Do not tank mix or alternate Agricide with benzimidazole or thiophanate products such as Mertect or Topsin. Do not use on Greenhouse crops, including Hydroponic grown crops. Do not use on any container grown crops. Do not use on ornamentals.**

Apply as a spray with ground equipment (except as otherwise directed), using sufficient water to obtain thorough coverage of plants. Under severe disease conditions use the higher rate and shorter interval specified for each crop; also, for tree crops, use the higher rate for larger mature trees.

For use in small gardens and orchards (less than 1 acre), application rates may be converted to lb per 100 gal by dividing the lb per acre rate in half, and applying the resulting spray mixture at the rate of 4.5 gal per 1000 sq ft (1 lb. Agricide per 100 gal equals 1 tablespoon per gal)

Add required amount of Agricide to necessary volume of water in spray tank agitated by hydraulic or mechanical means; continuous agitation is required to keep the material in suspension. Do not tank mix Agricide with lime or alkaline pesticides such as Bordeaux mixture or lime sulfur.

Where use of spray oil is recommended (apples, peanuts, pecans, stone fruits), use a nonphytotoxic superior-type (60 to 70 second viscosity) spray oil; add as last ingredient to spray tank. Before applying other pesticides in conjunction with spray oil or immediately before or after oil application, consult product labels. Observe all cautions and limitations on labeling of all products used in mixtures.

**CHEMIGATION:** Apply Agricide only through sprinkler including center pivot, lateral move, end tow, side (wheel) roll, traveler, big gun, solid set or hand move irrigation systems only on beans, carrots, celery, cucurbits, peanuts, strawberries or tomatoes. Do not apply Agricide to any other crops using chemigation.

Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from nonuniform distribution of treated water.

If you have questions about calibration, you should contact State Extension Service Specialists, equipment manufacturers or other experts.

Do not connect an irrigation system used for pesticide application to a public water system unless the pesticide label-prescribed safety devices for public water systems are in place.

A person knowledgeable of the chemigation system and responsible for its operation, or under the supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.

***Specific Instructions for Public Water Systems:***

1. Public water system means a system for the provision to the public of piped water for human consumption if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.
2. Chemigation systems connected to public water systems must contain a functional, reduced-pressure zone, backflow preventer (RPZ) or the functional equivalent in the water supply line upstream from the point of pesticide introduction. As an option to the RPZ, the water from the public water system should be discharged into a reservoir tank prior to pesticide introduction. There shall be a complete physical break (air gap) between the outlet and of the fill pipe and the top or overflow rim of the reservoir tank of at least twice the inside diameter of the fill pipe.
3. The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.
4. The pesticide injections pipeline must contain functional, normally closed, solenoid-operated located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
5. The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops, or in cases where there is no water pump, when the water pressure decreases to the point where pesticide distribution is adversely affected.
6. Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
7. Do not apply when wind speed favors drift beyond the area intended for treatment.

**Specific Instructions for Sprinkler Irrigation Systems:**

1. The system must contain a functional check valve, vacuum relief valve, and low pressure drain appropriately located on the irrigation pipeline to prevent water source contamination from backflow.
2. The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.
3. The pesticide injection pipeline must also contain a functional, normally closed, solenoid-operated valve located on the intake side of the injection pump and connected to the system interlock to prevent fluid from being withdrawn from the supply tank when the irrigation system is either automatically or manually shut down.
4. The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
5. The irrigation line or water pump must include a functional pressure switch which will stop the water pump motor when the water pressure decreases to the point where pesticide distribution is adversely affected.
6. Systems must use a metering pump, such as a positive displacement injection pump (e.g., diaphragm pump) effectively designed and constructed of materials that are compatible with pesticides and capable of being fitted with a system interlock.
7. Do not apply when wind speed favors drift beyond area intended for treatment.
8. Good agitation is required in the injection tank.
9. In moving systems, apply specified dosage of Agricide as a continuous injection. In nonmoving systems inject Agricide for 15 to 30 minutes at end of cycle. Use the least amount of water possible consistent with uniform coverage.
10. Mix the amount of Agricide needed for acreage to be treated into the quantity of water determined during prior calibration. For moving systems inject into the system continuously for one complete revolution of the field. For nonmoving systems inject into system for the time established during calibration.
11. Stop injection equipment after treatment is completed and continue to operate irrigation equipment until all Agricide is flushed from system.

**ALMONDS: Brown Rot Blossom Blight** - Apply 1 to 1 1/2 lbs. per acre at pink bud. Under severe disease conditions and on highly susceptible varieties, make a second application during half- to full-bloom.

**APPLES:** For applications through cover sprays, use Agricide as a tank mixture as detailed below. Apply 200 to 500 gals. of spray per acre with hydraulic ground equipment or equivalent amount of products per acre with concentrate sprayers. Do not graze livestock in treated orchards. **Agricide + Manzate 200 Fungicide: Scab, Powdery Mildew, Sooty Blotch, Flyspeck, Cedar Apple Rust, Quince Rust, Bitter Rot, Black Rot, Brown Rot** - Use 2 to 3 ozs. Agricide plus 12 ozs. Manzate 200 per 100 gals. of water; 1 qt. spray oil may be added per 100 gals. Apply at 1/2" green tip and repeat at 7- to 14-day intervals (or as needed) through the cover sprays. Use the 3 oz. rate of Agricide for varieties more susceptible to powdery mildew. If an application is missed during an infection period, apply the higher rates as soon as possible after the infection period in order to deactivate scab and to prevent further infections. **Note:** Spray injury may result if Captan is used with, immediately before, or closely following an oil spray.

**Postharvest Fruit Rots (Botrytis spp., Penicillium spp., Gloeosporium spp.)** - Make a single application of 6 ozs. Agricide per 100 gals. anytime from 3 weeks before harvest up to day of harvest. For additional protection of fruit to be held in storage, thoroughly wet harvested fruit by dipping or spraying at 8 ozs. per 100 gals.

**AVOCADOS (Florida): Scab, Cercospora Spot, Anthracnose** - Apply 1 to 2 lbs. per acre; begin when buds swell and repeat at 3- to 4-week intervals. Do not apply within 30 days of harvest.

**BEANS: White Mold (Sclerotinia), Gray Mold (Botrytis)** - Use on beans grown as fresh vegetables, for processing, or for the dry bean market. Apply 1 1/2 to 2 lbs. per acre at 25% to 50% bloom; repeat at peak bloom. For narrow-row (20-24") irrigated dry beans in Montan, Nebraska, Colorado and Wyoming, apply at initial bloom and repeat 7 to 10 days later; only partial control of white mold may result. Do not apply within 14 days of harvest (28 days for lima beans); do not use where crop is grown only for forage purposes.

**BLUEBERRIES:** Apply 1 lb. per acre. Do not make more than 4 applications before harvest; do not apply within 21 days of harvest. **Mummy Berry, Botrytis Blossom Blight** - Apply at green tip and repeat at 7- to 10-day intervals through petal fall. **Anthracoze Leafspot** - Apply when disease first appears and make one additional application 14 days later. After harvest, make up to 4 applications to the bushes at 14-day intervals as needed.

**CABBAGE (Seed Crop, Pacific Northwest): White Blight (Sclerotinia Stalk Rot)** - Apply 2 lbs. per acre by aircraft in 5 to 10 gals. of water; add a spreader-sticker to aid in wetting plants. Make first application at first petal fall; make two additional applications at 14-day intervals if conditions favor development of disease.

**Note:** Do not graze treated areas; do not use seed or plant parts for food or feed purposes.

**CANE BERRIES-RASPBERRIES, BLACKBERRIES, BOYSENBERRIES, LOGANBERRIES, DEWBERRIES:** **Botrytis, Powdery Mildew, Penicillium Rots** - Apply 3/4 lb. per acre at early bloom (5 to 10%) and at full bloom; make up to 3 additional applications at 14-day intervals as needed. Do not apply within 3 days of harvest.

**CELERY:** **Early Blight (Cercospora), Late Blight (Septoria)** - Apply 1/4 to 1/2 lb. per acre; begin when disease first appears and repeat at 7- to 10-day intervals. Do not apply within 7 days of harvest.

**CITRUS: Scab** - Apply 1 1/2 to 3 lbs. per acre. Under conditions of severe disease pressure, apply at pinhead stage (just prior to first flush) and repeat at 2/3 petal fall; otherwise, make a single application at 2/3 petal fall.

**Greasy Spot** - Make a single application of 1 1/2 to 3 lbs. per acre during the period mid-June to mid-July.

**Fruit Decay (Green Mold, Blue Mold, Stem-end Rot) - Preharvest Spray** - Make a single application of 1 to 2 lbs. per acre anytime from 3 weeks prior to harvest up to day of harvest. **Postharvest** - Apply as a dip, flood, or spray using 1 to 2 lbs. per 100 gals.; do not immerse fruit for more than 5 min. When citrus wax is used, Agricide may be incorporated into the wax spray. Use the higher rate on more susceptible fruits and when excessive inoculum levels are present. For control of sporulation (*Penicillium* spp.), apply as a spray in citrus wax using 4 lbs. Agricide per 100 gals.

**Note:** Do not graze livestock in treated groves.

**CUCURBITS - CUCUMBERS, MELONS, PUMPKINS, SUMMER AND WINTER**

**SQUASH: Target Spot (Cucumbers), Gummy Stem Blight, Powdery Mildew, Anthracnose** - Apply 1/4 to 1/2 lb. per acre; for aerial application, use 1/2 lb. per acre; for aerial application, use 1/2 lb. per acre. Begin applications when plants begin to run or when disease first appears, and repeat at 7- to 10-day intervals as needed. For target spot, use 7-day intervals as needed.

**GRAPES: Botrytis Bunch Rot** - Apply 1 to 1 1/2 lbs. per acre at first bloom (no later than 5% bloom) and repeat 14 days later if severe disease conditions persist. Make an additional application 3 to 4 weeks before harvest or when sugar begins to build; repeat 14 days later if conditions favorable for disease persist. Agricide does not control bunch rots caused by other organisms such as *Rhizopus* spp., *Alternaria* spp., and *Diplodia* spp.; these rots occur most frequently in high temperature areas such as the San Joaquin and Sacramento Valleys of California. **Powdery Mildew, Black Rot, Bitter Rot - East of Rockies** - Apply 3/4 to 1 1/2 lbs. per acre when foliage first develops and repeat at 14- to 21-day intervals, or as needed, until berries are full size.

**Note:** Do not apply within 7 days of harvest.

**MACADAMIA NUTS (Hawaii): Botrytis Blossom Blight** - Apply 1 3/4 lbs. per acre; a surfactant may be added to the spray to improve wetting of foliage. Begin applications 1 to 2 weeks prior to bloom, and repeat at 7- to 10-day intervals through the bloom period.

**MANGOES: Anthracnose** - Apply 1 to 2 lbs. per acre. Begin applications at first appearance of panicles (approx. 2" long), and repeat at weekly intervals until all fruits are set. Continue at 3- to 4-week intervals. Do not apply within 14 days of harvest.

**MUSHROOMS: Verticillium Spot (Dry Bubble)** - Use 1 lb. per 100 gals. and apply to bed surface at the rate of 12 1/2 gals. per 1000 sq. ft. apply immediately after casing and repeat at pinning; alternatively, if disease has occurred, apply to beds after picking and repeat 10 days later. Do not apply within 2 days of harvest.

**PEANUTS: Agricide + Manzate 200 Fungicide: Cercospora Leafspot, Rust, Ascochyta Web Blotch** - Apply 1/4 lb. Agricide plus 1 1/2 lbs. Manzate 200 per acre; spray oil may be added at the rate of 1 pt. to 1 qt. per acre. Begin applications 35 to 40 days after planting or when disease first appears. Repeat at following intervals: for Cercospora leafspot, 10 to 14 days; for rust, 7 to 10 days; for Ascochyta web blotch, 7 to 14 days. Do not apply within 14 days of harvest; do not graze or feed treated vines, hay, or hulls to livestock.

**PEARS: Scab, Powdery Mildew, Sooty Blotch, Flyspeck** - Use 4 to 6 ozs. per 100 gals. of water; apply 200 to 500 gals. of spray per acre with hydraulic ground equipment or equivalent amount of Agricide per acre with concentrate sprayers. Apply at 1/2" green tip and repeat at 7- to 14-day intervals (or as needed) through the cover sprays. If an application is missed during an infection period, use 6 ozs. per 100 gals. and apply as soon as possible after the infection period in order to deactivate scab and to prevent further infection. Do not graze livestock in treated orchards.

**Postharvest Fruit Rots (Botrytis spp., Penicillium spp., Gloeosporium spp.)** - Make a single application of 6 ozs. per 100 gals. anytime from 3 weeks before harvest up to day of harvest. For additional protection of fruit to be held in storage, thoroughly wet harvested fruit by dipping or spraying at 8 ozs. per 100 gals.

**Overwintering Scab** - Apply 8 ozs. per 100 gals. after harvest but before leaf drop. Thorough wetting of foliage is necessary.

**PECANS: Pecan Scab, Brown Leafspot, Downy Spot, Powdery Mildew, Liverspot, Zonate Leafspot, Fungal Leaf Scorch** - Apply 1/2 to 1 lb. per acre; use the higher rate on trees over 30 feet tall. For aerial application (Ark., La., Miss., Okl., Tex. only), use 1 lb. per acre. Spray oil may be added at the rate of 1 to 2 gals per acre. Apply at prepollination when young leaves are unfolding, when small nuts are forming, and thereafter at 3- to 4-week intervals. Do not apply after shucks split.

**PINEAPPLE: Thielaviopsis Rot (Fresh Fruit)** - Use 2 to 4 lbs. per 100 gals. of water. Immediately after harvest, immerse or spray fruit to give thorough wetting and allow to drain; do not immerse for more than 5 min. **Pineapple Butt Rot (Thielaviopsis paradoxa)** - Use 1 1/4 lbs. per 100 gals. of water as a preplant dip treatment. Immerse seedpieces to give thorough wetting; remove and allow to drain.

**RICE (Except Calif.): Rice Blast, Stem Rot** - Apply 1 to 2 lbs. per acre at booting and repeat at heading. Do not apply within 21 days of harvest. Do not apply to stubble rice. Do not apply to fields where crayfish or catfish farming is practiced, nor drain water from treated areas into areas where such farming is practiced. Water drained from treated areas must not be used to irrigate other crops.

**SOYBEANS: Diaporthe Pod-and Stem Blight, Anthracnose, Septoria Brown Spot, Cercospora Frogeye Leafspot, Purple Seed Stain** - Apply 1/2 to 1 lb. per acre. For **determinate** varieties (generally grown in the South), apply at early pod set when majority of pods are 1/8 to 1/2" in length; for **indeterminate** varieties (generally grown in the North), apply when pods near the top of the plant are 1/2 to 1" in length. Make one additional application 14 to 21 days later. Do not apply within 35 days of harvest; do not graze or feed treated soybean vines or hay to livestock.

**STONE FRUITS - APRICOTS, CHERRIES, NECTARINES, PEACHES, PLUMS, PRUNES:** Treatment is most effective if applied just before rainfall; for aerial application, fly over every row or center.

**EAST OF ROCKY MOUNTAINS** - Use 3/4 to 1 1/2 lbs. per acre on trees up to 12 feet tall; over 12 feet, use 1 1/2 to 2 lbs. per acre.

**Brown Rot Blossom Blight** - Apply at early bloom stages (apricots - red bud; peaches, nectarines - pink bud; cherries - early popcorn; plums and prunes - green tip); for this application only, Agricide may be used in combination with spray oil. Make a second application at 75% to 100% bloom. If blossoming is prolonged or conditions favorable for disease persist, apply at petal fall.

**Fruit Brown Rot** - After blossom blight sprays, make two preharvest applications beginning 3 weeks before harvest up to day of harvest.

**Peach Scab, Powdery Mildew** - Use same schedule as for Brown Rot Blossom Blight plus applications at shuck split, shuck fall and 14 days later.



**Cherry Leaf Spot** - Use same schedule as for Brown Rot Blossom Blight and continue at 10-14 day intervals through harvest. Make an additional application 2 to 3 weeks after harvest.

**WEST OF ROCKY MOUNTAINS** - Use 1 1/2 to 2 lbs. per acre.

**Brown Rot Blossom Blight** - Apply at early bloom stages (apricots - red bud; peaches, nectarines - pink bud; cherries - early popcorn; plums and prunes - green tip); for this application only, Agricide may be used in combination with spray oil. If blossoming is prolonged or conditions favorable for disease persist, make a second application 14 days later.

**Fruit Brown Rot** - After blossom blight sprays, make a preharvest application (before rain) any time from 3 weeks before harvest to day of harvest. Make a second application if conditions favorable for disease persist or harvest is prolonged. Preharvest applications are most effective when applied with ground equipment, using sufficient volume to provide thorough and uniform coverage of fruit.

**Powdery Mildew** - Use same schedule as for Brown Rot Blossom Blight plus applications at shuck split, shuck fall and 14 days later.

**Cherry Leaf Spot** - Use same schedule as for Brown Rot Blossom Blight and continue at 10-14 day intervals through harvest. Make an additional application 2 to 3 weeks after harvest.

**Post-Harvest Fruit Rot (U.S.)** - Dip or spray fruit thoroughly as soon as possible after harvest; use 1/2 lb. per 100 gals. When wax is used, Agricide may be incorporated into the wax spray.

**NOTE:** Agricide does not control peach leaf curl, shot hole (*Coryneum blight*) or bacterial blast, nor fruit rots caused by *Rhizopus spp.* and *Alternaria spp.* Do not graze livestock in treated orchards.

**STRAWBERRIES: Gray Mold (Botrytis), Powdery Mildew, Leaf Scorch, Leaf Blight, Leaf Spot** - Apply 1 lb. per acre at 10% bloom and at full bloom; continue at 10-14 day intervals, using 1/2 lb. per acre. **Anthracnose** - Apply 1 lb. per acre when plants are established (plant bed or field) and repeat at 7-day intervals.

**Transplants: Botrytis Crown Rot, Leaf Spot** - Use 1/2 lb. per 100 gals. of water. Immerse plants to give thorough wetting; remove and allow to drain.

**SUGAR BEETS: Cercospora Leafspot** - Apply 3/8 to 1/2 lb. per acre. Begin application when disease first appears and repeat at 14- 21day intervals as needed. Do not apply within 21 days of harvest.

**SUGARCANE (HAWAII): Pineapple Disease (Ceratocystis paradoxa)** - Apply to cut seedpieces either as a cold dip or hot dip.

**Cold dip** - Use 1/2 lb. per 100 gals. of water (1:1600). Immerse seedpieces to give thorough wetting; remove and allow to drain.

**Hot dip** - Use 1/4 lb. per 100 gals. of water (1:3200). Maintain temperature of the dip at 50 C. Soak seedpieces for 20 to 30 minutes; remove and allow to drain.

**Note:** Do not use treated seedpieces for food or feed purposes.

**TOMATOES - Field and Greenhouse: Gray Mold (Botrytis), Leaf Mold (Cladosporium), White Mold (Sclerotinia), Cercospora Leafspot, Phoma Leafspot** - For field tomatoes, apply 1/2 to 1 lb. per acre; for greenhouse, use 1/2 to 1 lb. per 100 gals. of water. Begin applications when disease first appears and repeat at 7-14 day intervals as needed.

**ROSES, FLOWERS, ORNAMENTALS, SHADE TREES - Field and Greenhouse:**

**Foliar Spray** - Begin applications when disease first appears and repeat at 10-14 day intervals throughout the growing season; shorten interval during humid, rainy weather. Use at the following rates: **1/2 lb. per 100 gals.** (1 tablespoonful per 2 gals.) - for Powdery Mildew, Botrytis Gray Mold. **1 lb. per 100 gals.** - for Anthracnose (for shade trees and woody ornamentals, being at bud break and make 2 or 3 additional applications at 10- to 14-day intervals); Black Spot of roses; Cercospora, Entomosporium, Ramularia, and Septoria Leafspots; Ascochyta and Phomopsis blights; Didymellina Leafspot of iris; Corynespora Leafspot of Ligustrum; Ovulinia Blight of azalea and rhododendron (begin as flowers open); Scab of pyracantha and flowering crab. Addition of a surfactant to the spray mixture improves distribution of the spray on hard-to-wet plants such as roses. For aerial application, use 1/2 to 1 lb. per acre.

**Drench Treatment** - Botrytis, Fusarium, Rhizoctonia and Sclerotinia stem, crown and root rots on herbaceous annuals, perennials and bedding plants; Clindrocladium and Thielaviopsis rots on woody ornamentals such as azaleas, rhododendrons, conifers, and poinsettias - Use 1 lb. per 100 gals.; apply as a drench or heavy spray (1 to 2 pts. per sq. ft.) after transplanting into propagation beds or containers Repeat at 2- to 4-week intervals during periods favorable for disease. Agricide does not control *Pythium spp.* or *Phytophthora spp.*

**Preplant Dip Treatment** - For diseases listed under Drench Treatment, use 1 lb. per 100 gals. of water; immerse plants or cuttings for 10 to 15 min.; remove and allow to drain.

**BULBS (Easter Lily, Tulip, Gladiolus, Daffodil, Iris): Fusarium and Penicillium Rots** - Use 1 2/3 lbs. per 100 gals. of water (2 tablespoonfuls per gal.) Soak cleaned bulbs for 15 to 30 minutes in warm dip (80-85° F), preferably within 48 hours after digging. Dry bulbs after treatment. If bulbs are for forcing, treat after bulbs have been heat-cured.

### STORAGE AND DISPOSAL

Do not contaminate water, other pesticides, fertilizer, food or feed by storage or disposal.

**STORAGE:** Never allow Agricide to become wet during storage. This may lead to certain chemical changes which will reduce the effectiveness of Agricide as a fungicide. Keep container tightly closed when not in use. Store product in original container only.

**PRODUCT DISPOSAL:** Do not contaminate water, food or feed by storage or disposal. Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

**CONTAINER DISPOSAL:** Completely empty bag into application equipment. Then dispose of empty bag in a sanitary landfill or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

### NOTICE OF WARRANTY

Lidcar warrants that this product conforms to the chemical description on the label thereof and is reasonably fit for purposes stated on such label only when used in accordance with directions under normal use conditions. It is impossible to eliminate all risks inherently associated with the use of this product. Crop injury, ineffectiveness, or other unintended consequences may result because of such factors as weather conditions, presence or other materials, or the manner of use or application, all of which are beyond the control of Lidcar. In no case shall Lidcar be liable for consequential, special or indirect damages resulting from the use or handling of this product. All such risks shall be assumed by the buyer. LIDCAR MAKES NO WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE NOR ANY OTHER EXPRESS OR IMPLIED WARRANTY EXCEPT AS STATED ABOVE.

### NOTICE TO BUYER

Purchase of this material does not confer any rights under patents of countries outside of the U.S.

LIDCAR (Inc.), AGRICULTURAL PRODUCTS, ALBANY, NEW YORK.

## Practice Your Math Skills

It will be easier to do pesticide calculations if you can answer the following questions. If you cannot get the answers, ask someone to help you.

Give the decimal number for each of these:

**Ex:**  $1/2 = \underline{0.50}$       **one point five**  $\underline{1.5}$

- |                                |   |
|--------------------------------|---|
| 1) $1/4 = \underline{0.25}$    | 6) zero point two $\underline{0.2}$       |
| 2) $1/3 = \underline{0.33}$    | 7) zero point two five $\underline{0.25}$ |
| 3) $2/3 = \underline{0.67}$    | 8) point three three $\underline{0.33}$   |
| 4) $2\ 1/4 = \underline{2.25}$ | 9) four point three $\underline{4.3}$     |
| 5) $5\ 4/8 = \underline{5.50}$ | 10) eleven point six $\underline{11.6}$   |

Give the fraction for each of these:

**Ex:**  $0.5 = \underline{1/2}$       **two thirds**  $\underline{2/3}$

- |                                 |   |
|---------------------------------|---|
| 11) $0.25 = \underline{1/4}$    | 16) one fourth $\underline{1/4}$          |
| 12) $0.33 = \underline{1/3}$    | 17) one third $\underline{1/3}$           |
| 13) $0.75 = \underline{3/4}$    | 18) two eighths $\underline{2/8}$         |
| 14) $3.67 = \underline{3\ 2/3}$ | 19) seven sixteenths $\underline{7/16}$   |
| 15) $6.50 = \underline{6\ 1/2}$ | 20) one and one half $\underline{1\ 1/2}$ |

Round off each of these decimals to the nearest tenth:

- 21) 0.667 = 0.7
- 22) 0.55 = 0.6
- 23) 0.398 = 0.4
- 24) 1.54 = 1.5

Round off each of these decimals to the nearest hundredth:

- 25) 0.333 = 0.33
- 26) 4.3445 = 4.35
- 27) 8.1666667 = 8.17

Fill in the blanks:

- Ex: 60 seconds = 1.00 minute**
- 28) 25 seconds = 0.42 minute
- 29) 15 seconds = 0.25 minute
- 30) 180 seconds = 3.00 minutes
- 31) 236 seconds = 3.93 minutes
- 32) 5 oz. = 0.31 pound
- 33) 12.5 oz. = 0.78 pound
- 34) 44 oz. = 2.75 pounds
- 35) 85 1/2 oz. = 5.34 pounds

Fill in the blanks:

**Ex: 1 pound = 16.0 oz.**

36) 1/2 pound = 8.0 oz.

37) 2 pounds = 32 oz.

38) 3.5 pounds = 8.0 oz.

39) 6 1/2 pounds = 8.0 oz.

**Ex: 1 pint = 16.0 fl. oz.**

40) 1/3 pint = 5.33 fl. oz.

41) 2 pints = 32.0 fl. oz.

42) 3 1/3 pints = 53.3 fl. oz.

43) 4.67 pints = 74.7 fl. oz.

**Ex: 128 fl. oz. = 1.00 gallon**

44) 33 fl. oz. = 0.26 gallon

45) 75.5 fl. oz. = 0.59 gallon

46) 138 fl. oz. = 1.08 gallons

47) 150 1/2 fl. oz. = 1.18 gallons

**Ex: 43,560 sq. ft. = 1.000 acre**

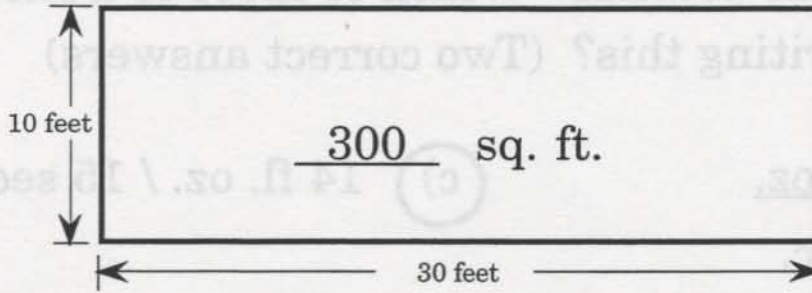
48) 200 sq. ft. = 0.005 acre

49) 1,555 sq. ft. = 0.036 acre

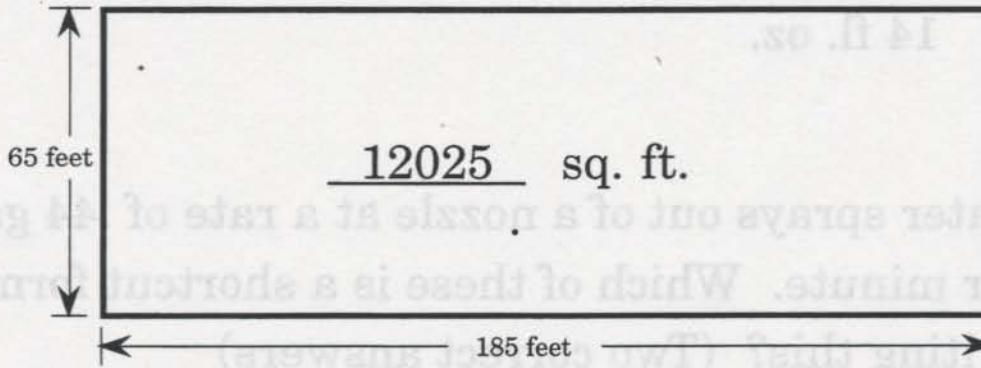
50) 18,750 sq. ft. = 0.430 acre

51) 41,315 sq. ft. = 0.948 acre

52) How many square feet are in this field?

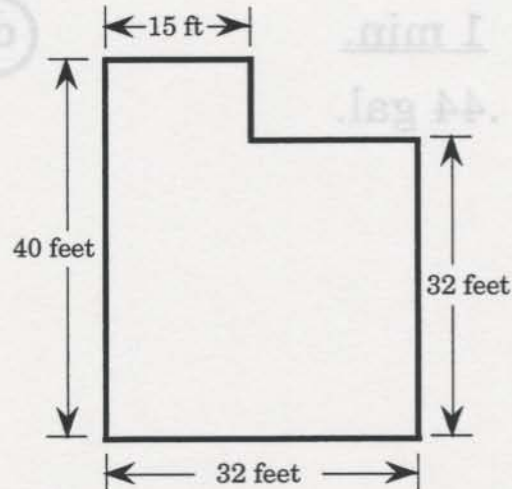


53) How many square feet are in this field?



54) This is a sketch of a house foundation. How many square feet are in this foundation?

$\underline{1144}$  sq. ft.



55) Water sprays out of a nozzle at a rate of 14 fluid ounces in 15 seconds. Which of these is a shortcut form of writing this? (Two correct answers)

(a)  $\frac{14 \text{ fl. oz.}}{15 \text{ sec.}}$

(c)  $14 \text{ fl. oz.} / 15 \text{ sec.}$

b)  $\frac{15 \text{ sec.}}{14 \text{ fl. oz.}}$

d)  $15 \text{ sec.} / 14 \text{ fl. oz.}$

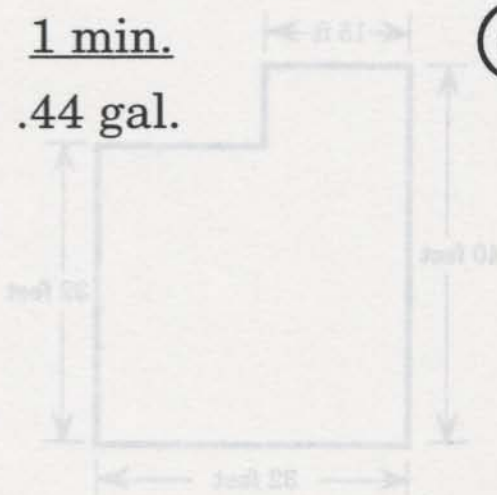
56) Water sprays out of a nozzle at a rate of .44 gallons per minute. Which of these is a shortcut form of writing this? (Two correct answers)

(a)  $\frac{.44 \text{ gal.}}{1 \text{ min.}}$

c)  $1 \text{ min.} / .44 \text{ gal.}$

b)  $\frac{1 \text{ min.}}{.44 \text{ gal.}}$

(d)  $.44 \text{ gal.} / \text{min.}$



57) I use 3 gallons of spray mixture to treat 1,000 square feet of lawn. Which of these items is the shortcut form of writing this? (Two correct answers)

- a) 3 gal.  
1000 sq. ft.
- c) 1000 sq. ft.  
3 gal.
- b) 3 gal. / 1000 sq. ft.
- d) 1000 sq. ft. / 3 gal.

58) I need 180 gallons of spray mixture to treat 1 acre of lettuce. Which of these items is a shortcut form of writing this? (Two correct answers)

- a) 180 gal.  
acre
- c) 180 gal. / 1 acre
- b) 1 acre  
180 gal.
- d) 1 acre / 180 gal.



## History of U.S. Pesticide Laws

1. Federal Insecticide Act (1910)
2. FIFRA (1947)
  - a. Enforced by USDA until 1970
  - b. Illegal to remove or destroy labels
  - c. Did not regulate pesticide manufacture or use within the states.
3. Synthetic pesticides (1940-1950)
  - a. Cheap and widely available
  - b. Widespread use and misuse
  - c. *Silent Spring* (1962)
    - i. A book by Rachel Carson
    - ii. Publicized negative environmental effects of pesticides such as DDT.
4. EPA assumes enforcement of FIFRA (1970)
5. FEPCA (1972)
  - a. Also known as "amended FIFRA"
  - b. Mission: To protect man and the environment from "unreasonable adverse effects" of pesticides.

## U.S. Federal Pesticide Laws

1. F.E.P.C.A. = Federal Environmental Pesticide Control Act; 1972.
  - a. Also known as “amended FIFRA”, Federal Insecticide, Fungicide and Rodenticide Act, 1947, or just FIFRA.
  - b. Enforced by Environmental Protection Agency (EPA).
  
2. E.S.A. = Endangered Species Act
  - a. Protects endangered species and their habitats.
  
  - b. Administered by U.S. F.W.S. (Fish & Wildlife Service).
  
  - c. Pesticide applicators must follow label directions regarding E.S.A.

## U.S. EPA Authority Under FEPCA

1. Register all pesticides.
2. Classify all pesticides as either restricted-use or non-restricted (general-use) pesticides.
3. Authorize certification of restricted pesticide users.
4. Authorize enforcement of the Misuse Statement.
5. Suspend (temporarily stop) sale and/or use.
6. Cancel registered uses for a pesticide.
7. Allow experimental uses.
8. Allow emergency uses.
9. Allow special local need uses.
10. Conduct special reviews of suspect pesticides.
11. Set tolerance for pesticide residues in and on agricultural products.

## U.S. Federal Pesticide Laws

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  - c. Pesticide applicators must follow label directions regarding E.S.A.

## Residue and Tolerance

1. Residue
  - a. Chemical that remains on or in a surface after it has been treated with or exposed to a pesticide.
  - b. Residue may remain on or in:
    - a. Crops or animals
    - b. Equipment
    - c. Water
    - d. Soil
    - e. Air
  - c. Measured in parts per million (ppm)\* and sometimes in parts per billion (ppb).
2. Tolerance
  - a. Amount of pesticide that may legally remain on or in any farm product at the time of sale if the crop or animal is food or livestock feed.
  - b. Listed in ppm.
  - c. List of tolerances in U.S. Code of Federal Regulations.
  - d. U.S. EPA sets tolerance for agricultural products.

\* 1 ppm mixture of sugar in water is equal to one 1/2 teaspoon of sugar dissolved in about 832 gallons of water.

# Government Regulation

The blank circles represent agencies that may provide some form of regulation in your area. Fill them in as appropriate.

Pesticide **registered** by manufacturer



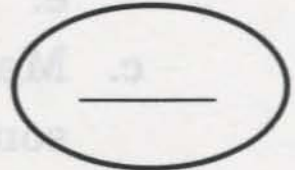
Pesticide **manufactured/packaged** by manufacturer



Pesticide **sold** by distributor



Pesticide **used** by applicator



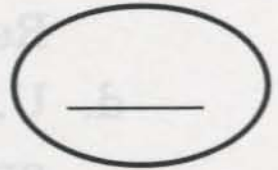
## Off Target

Pollution = Pesticide residue in air, soil, and water may affect "non-target organisms" (wildlife, other crops, pets, workers, neighbors).

## On Target

Benefits = Pesticide residue on treated crop, site, or animals, can control pests.

Pesticide residue may or may not be found on food or feed.



Pesticide residue breaks down into "non-toxic" substances (some quickly, some slowly).

## Record Keeping for Applicators

1. Record this information for each application of any restricted-use pesticide:
  - a. Brand name or common name of pesticide
  - b. EPA Registration Number
  - c. Formulation of pesticide
  - d. Percent active ingredient
  - e. Date of application
  - f. Address or location of treated site
  - g. Area covered (sq. ft., acres, etc.)
  - h. Dilution rate of pesticide
  - i. Amount of pesticide used
  - j. Name and certification number of certified applicator (on your card)
  - k. Scientific or common name of target pest
  
2. Keep records for two years.

# Sample Record-Keeping Form

## Record of Pesticide Application

Metholate L 587-201  
 Name of Product EPA Reg. No.

Water-soluble liquid 24%  
 Type of Formulation Active Ingredient %

Date	Address	Area Covered	Dilution	Amount Applied	Name & Permit #	Crop & Pest
1/1/91	123 Pacific St.	1/4 acre	1 cup/50 gal.	1 cup	John Doe CA-4567	Cucumber Thrips



# Sample Record-Keeping Form

## Record of Pesticide Application

Date and time of application \_\_\_\_\_

Location of treated site \_\_\_\_\_

Crop variety \_\_\_\_\_

Age of crop \_\_\_\_\_

<u>Chemical(s) applied</u>	<u>Formulation(s)</u>	<u>Total formulation used</u>
----------------------------	-----------------------	-------------------------------

\_\_\_\_\_

\_\_\_\_\_

When applied: \_\_\_\_\_ Preplant \_\_\_\_\_ Pre-emergence \_\_\_\_\_ Post-emergence

Total area treated \_\_\_\_\_

Total amount of water used \_\_\_\_\_

Target pest \_\_\_\_\_

Temperature \_\_\_\_\_

Wind direction \_\_\_\_\_

Wind velocity: \_\_\_\_\_ 0-5 mph \_\_\_\_\_ 5-10 mph \_\_\_\_\_ over 10 mph

\_\_\_\_\_ backpack sprayer \_\_\_\_\_ boom sprayer

\_\_\_\_\_ mist blower \_\_\_\_\_ other (specify)

Nozzles used (type and size) \_\_\_\_\_

Operation pressure \_\_\_\_\_

Operation speed \_\_\_\_\_



### Commercial Applicators Only

Name of certified applicator \_\_\_\_\_

Certification number \_\_\_\_\_

Address of treated site \_\_\_\_\_

Dilution rate \_\_\_\_\_

Percent active ingredient \_\_\_\_\_

EPA registration number \_\_\_\_\_

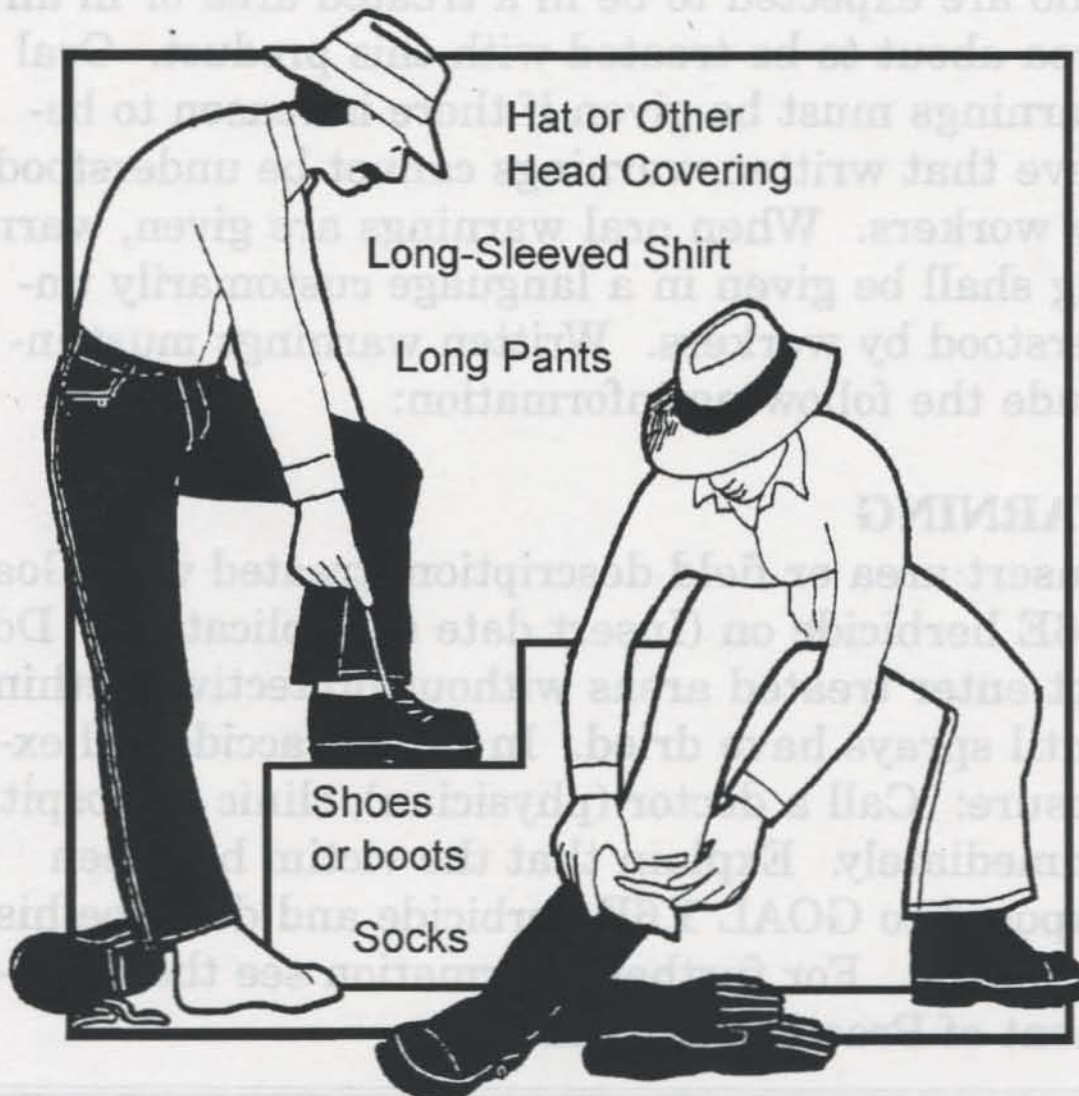
## Summary of Worker Protection

### Standards for Agricultural Pesticides

1. The purpose is to prevent pesticide exposure by workers doing manual labor.
2. Protect workers during spraying or from residues on treated plants.
3. Responsibility of employer and employee.
4. Directions on pesticide labels
  - a. Constantly upgraded to comply with regulations.
  - b. Follow label directions if more strict than regulations.
5. Worker safety
  - a. Warn workers about treated areas or areas that will be treated.
  - b. Keep unprotected workers out of treated areas as described on pesticide label.
  - c. Post warning signs or give verbal warnings, in a foreign language if necessary.
  - d. Prevent worker exposure to spray drift.

## Minimum Protective Clothing

1. Hat or other suitable head covering.
2. Long-sleeved shirt.
3. Long pants or coverall garment. (Shirt and pants to be of closely woven fabric.)
4. Shoes and boots and socks.



## Sample Re-Entry and Worker Protection Statement

From GOAL 16E label:

Do not enter treated areas without protective clothing until sprays have dried...

Written or oral warnings must be given to workers who are expected to be in a treated area or in an area about to be treated with this product. Oral warnings must be given if there is reason to believe that written warnings cannot be understood by workers. When oral warnings are given, warning shall be given in a language customarily understood by workers. Written warnings must include the following information:

### **WARNING**

(Insert area or field description) treated with Goal 1.6E herbicide on (Insert date of application). Do not enter treated areas without protective clothing until sprays have dried. In case of accidental exposure: Call a doctor (physician), clinic or hospital immediately. Explain that the victim has been exposed to GOAL 1.6E herbicide and describe his condition. For further information see the Statement of Practical Treatment.

## **“Label” and “Labelling” Definitions from Amended FIFRA**

1. **Label**: The written, printed, or graphic matter on, or attached to, the pesticide or device or any of its containers or wrappers.
2. **Labelling**: All labels and all other written, printed, or graphic matter that
  - a. Accompanies the pesticide or device at any time.

OR

- b. To which reference is made on the label or in literature accompanying the pesticide or device (except to publications of government agencies authorized to do pesticide research.)

## Importance of Labels

1. A pesticide label is a list of the legal (registered) uses and the precautions you need to take.
2. A pesticide label is a printed message from the manufacturer to you.
3. Some of the information on a pesticide label
  - a. Contents of container.
  - b. Directions for safe use.
  - c. First aid for exposure (“Statement of Practical Treatment”).
4. Read the label **BEFORE** you:
  - a. Buy the pesticide.
  - b. Mix and apply the pesticide.
  - c. Store the pesticide.
  - d. Dispose of unwanted pesticide or the container.

## Situation and Question for Discussion

### Situation:

You are cleaning your pesticide storage cabinet and find a 1-gallon mayonnaise jar containing a grayish-white powder. The only identifying information is hand-written on a scrap of paper and taped to the jar. It says:

**Poison!**  
**PESTICIDE!**

Instead of throwing it away, you would rather use the powder for its correct purpose.

### Question:

How would you know the correct use for this pesticide?

### Answer:


There is no way to know for sure and proper disposal is very difficult. Save all labels!

## Types of Labeling

1. Label on or attached to pesticide container.
2. Supplemental labeling
  - a. Not on or attached to container.
  - b. Directions based on tolerance.
  - c. Must have a copy in your possession.
  - d. Refers to only one pesticide brand name.



# Parts of a Standardized Label

<p>PRECAUTIONARY STATEMENTS</p> <p>HAZARDS TO HUMANS &amp; DOMESTIC ANIMALS DANGER</p> <hr/> <p>ENVIRONMENTAL HAZARDS</p> <hr/> <p>PHYSICAL &amp; CHEMICAL HAZARDS</p> <hr/>	<p>← 5</p>	<p>RESTRICTED USE PESTICIDE ← 3</p> <p>FOR RETAIL SALE TO AND APPLICATION ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION</p>	<p>CROP: _____</p> <p>_____</p> <p>CROP: _____</p> <p>_____</p>
		<p>PRODUCT NAME ← 1</p>	
		<p>ACTIVE INGREDIENTS ..... % ← 2</p> <p>INERT INGREDIENTS ..... %</p> <p>TOTAL 100%</p>	
		<p>THIS PRODUCT CONTAINS ___ LBS OF ___ PER GALLON</p>	<p>CROP: _____</p> <p>_____</p>
<p>DIRECTIONS FOR USE ← 11</p> <p>It is a violation of federal law to use this product in a manner inconsistent with its labeling.</p> <p>RE-ENTRY STATEMENT (If applicable)</p> <hr/> <p>CATEGORY OF APPLICATOR</p> <hr/> <p>STORAGE AND DISPOSAL</p> <hr/> <hr/>		<p>KEEP OUT OF REACH OF CHILDREN DANGER - POISON ← 4</p> 	<p>CROP: _____</p> <p>_____</p>
		<p>STATEMENT OF PRACTICAL TREATMENT ← 6</p> <p>IF SWALLOWED _____</p> <p>IF INHALED _____</p> <p>IF ON SKIN _____</p> <p>IF IN EYES _____</p>	<p>CROP: _____</p> <p>_____</p>
		<p>SEE SIDE PANEL FOR ADDITIONAL PRECAUTIONARY STATEMENTS</p> <p>MANUFACTURERS NAME, CITY, STATE ← 7</p>	
		<p>ESTABLISHMENT NO. ← 8</p>	<p>WARRANTY STATEMENT</p> <p>_____</p>
		<p>EPA REGISTRATION NO. ← 9</p>	
		<p>NET CONTENTS ← 10</p>	<p>_____</p> <p>_____</p>

1. Brand name
  - a. Name of the product.
  - b. Usually in the largest print.
  - c. May contain a trademarked name.
  
2. Ingredient statement
  - a. Active ingredients
    - i. Percentage by weight for each active ingredient.
    - ii. For liquid pesticides, pounds per gallon of active ingredient are also listed.
    - iii. Chemical name always given.
    - iv. Common name sometimes given.
    - v. Some pesticides contain more than one active ingredient.
  - b. Inert ingredients
  
3. Statement of Use Classification
  - a. Indicates whether pesticide is restricted-use.
  - b. Classification based on
    - i. Poisoning hazards.
    - ii. Use patterns.
    - iii. Effects on environment and wildlife.

4. Signal words and symbols
  - a. Describe levels of acute toxicity to people.
  - b. Based on LD<sub>50</sub>, LC<sub>50</sub>, and effects on skin and eyes.  
(See table on page 53.)
  - c. Three signal words
    - i. "Caution" indicates low toxicity.
    - ii. "Warning" indicates moderate toxicity.
    - iii. "Danger" indicates high toxicity.
  - d. Symbols



Skull-and-crossbones symbol and "Poison" add special meaning to the signal word, "Danger".

5. Precautionary statements
  - a. Hazards to humans and domestic animals
    - i. Tells how you may be poisoned.
    - ii. Protective clothing and equipment.
    - iii. Notice to physician on highly toxic pesticides.
  - b. Environmental hazards
    - i. Possible harm to wildlife and beneficial insects.
    - ii. Drift.
    - iii. Disposal.
  - c. Physical and chemical hazards concerning fire, explosion, and corrosion.

6. Statement of Practical Treatment lists first aid procedures if pesticide is:
  - a. Swallowed.
  - b. Inhaled.
  - c. In eyes.
  - d. On skin.
  
7. Net contents
  - a. Tells how much pesticide is in the container.
  - b. Given in pounds, ounces, gallons, quarts, pints, fluid ounces, etc.
  
8. Manufacturer's name
  - a. Name of company that makes the pesticide.
  - b. Must be on the label.
  
9. EPA Establishment Number (EPA Est. No.) identifies specific factory that makes the pesticide.
  
10. EPA Registration Number (EPA Reg. No.)
  - a. Proof that pesticide is registered with EPA.
  - b. Unique number for each product.
  - c. Must be on the label.
  - d. Usually on front panel of label.

## 11. Directions for use

- a. Information about pesticide
  - i. Pests that can be controlled.
  - ii. Crop, animal, or site that can be treated.
  - iii. Dilution requirements.
  - iv. How much to use.
  - v. Application method.
  - vi. Timing of application.
- b. Misuse statement
  - i. 'It is a violation of federal law to use this product in a manner inconsistent with its labeling.'
  - ii. Reminds you that it is illegal to misuse the pesticide.
- c. Storage and disposal directions.
- d. Re-entry statements and worker protection precautions.

## Signal Words

Signal Word	Toxicity Category	Oral LD50 (mg/kg)	Inhalation LC50 (mg/kg)	Dermal LD50 (mg/kg)	Eye Effects	Skin Effects
DANGER	I	0 to 50 A taste to a teaspoon.**	0 to 0.2	0 to 200	Corrosive. Corneal opacity not reversible within 7 days.	Corrosive.
WARNING	II	50 to 500 One teaspoon to two tablespoons.**	0.2 to 2	200 to 2000	Corneal opacity not reversible within 7 days. Irritation persists for 7 days.	Severe irritation at 72 hours.
CAUTION	III	500 to 5000 Eleven ounces to a pint.**	2.0 to 20	2000 to 20000	No corneal opacity. Irritation reversible within 7 days.	Moderate irritation at 72 hours.
CAUTION	IV	Greater than 5000. More than a pint.**	Greater than 20.	Greater than 20000.	No irritation.	Mild or slight irritation at 72 hours.

\*\* This amount, if swallowed, would probably be lethal to the average 70 kg. (154 lb) adult.

Adapted from Hawaii Department of Agriculture Regulations, Title 4, Subtitle 6, Chapter 66, Section 4-66-18.  
Prepared by the Cooperative Extension Service, College of Tropical Agriculture, University of Hawaii.

## **Precautionary Statement About Endangered Species**

From TURCAM® label:

### **ENDANGERED SPECIES RESTRICTIONS:**

The use of any pesticide in a manner that may kill or otherwise harm an endangered or threatened species or adversely modify their habitat is a violation of federal laws. The use of this product on golf courses and sod farms in San Bernardino County, California and on the islands of Hawaii and Maui is prohibited.

## Corrosion Hazard Warning

From BAYGON® 1.5 label:

**CAUTION:** Do not use in fiberglass tanks. The spray mixture made from this formulation may loosen paint coatings in metal tanks if allowed to stand for more than a few hours. Clean tanks thoroughly before and after use.



## **Precautionary Statement to Pesticide Applicators**

From the FUSILADE 2000® label:

It is impossible to test every species and variety or cultivar of ornamental or nursery plants under all conditions. Plant tolerance of pesticides vary as conditions vary. Plant tolerance of FUSILADE 2000® at label rates has been found to be acceptable within the ranges specified for the indicated genera and species. Neither the manufacturer nor the seller has determined whether or not FUSILADE 2000® can safely be used on plants not specified on this label. The professional user should determine if FUSILADE 2000® can be used safely prior to use.

## The Misuse Statement

“It is a violation of Federal law to use any pesticide in a manner inconsistent with its labeling.”

1. Crop, animal, or site to be treated must be listed on label. Beware of timing restrictions.
2. Dosage
  - a. Given in ounces per 1,000 sq. ft., ounces per 1,000 cubic ft., lbs. per acre, etc.
  - b. Do not apply higher dosage than specified.
3. Dilution
  - a. Given in ounces per 5 gallons water, pints per 100 gallons water, etc.
  - b. Do not use a stronger mixture than specified.
4. Safety equipment and protective clothing must be used if required by label.
5. Drift control: Beware of wind conditions.
6. Storage of pesticide containers.
7. Disposal of empty pesticide containers.
8. Frequency of use.
9. Application methods and equipment.
10. Chemigation may be used only if label allows it and gives specific instructions.

## Label Interpretation

1. You may use less than the dosage specified on the label.
2. You may use a concentration less than that specified on the label.
3. You may apply a pesticide less frequently than specified on the label.
4. As long as the label allows treatment of the crop, animal, or site, you may apply a pesticide to control a pest that is not named on the label unless the label expressly prohibits this.
5. You may use a method of application other than that specified on the label as long as the label does not prohibit this method.
6. You may mix the pesticide with another pesticide or with a fertilizer unless the label specifically prohibits such mixtures.

## Solid Pesticide Formulations

1. Soluble powder
  - a. Forms solution when mixed with water.
  - b. Some products are difficult to dissolve.
  - c. Water-soluble bags contain measured amounts and dissolve in mixing tank so they are less dusty and safer to handle.
  
2. Wettable powder
  - a. Abbreviation, WP or W, sometimes part of name (e.g., AATREX® 80W).
  - b. Forms suspension when mixed with water.
  - c. Should be pre-mixed by making a slurry.
  - d. Needs continuous agitation to keep spray mixture even.
  
3. Water dispersable granules
  - a. A wettable powder compressed into granules the size of large grains of sand.
  - b. Some products should be pre-mixed.
  - c. Needs continuous agitation to keep spray mixture even.
  - d. Less dusty than wettable powder therefore safer to handle.

4. Dusts
  - a. Abbreviation, D, sometimes part of brand name (e.g., FICAM® D).
  - b. Often used dry, as it comes from the container.
  - c. Low percentage of active ingredient (1/2% to 10%).
  - d. Difficult to control drift if used in open air.
  
5. Granules, Granular
  - a. Abbreviation, G, sometimes part of brand name (e.g., RONSTAR® G).
  - b. Used dry.
  - c. Does not stick to dry leaves, falls to ground.
  - d. Sometimes attractive to birds when applied to open field.
  
6. Bait
  - a. Sold in many different shapes, sizes, and packages.
  - b. Examples: Rat, mouse, snail, cockroach, ant, and bird baits.

## Liquid Pesticide Formulations

1. Water-soluble liquid forms solution when mixed with water.
2. Emulsifiable or emulsible concentrate
  - a. Abbreviation, EC or E, sometimes part of the pesticide's brand name.
  - b. Example: Dimethogon® 267 EC.
  - c. Forms emulsion when mixed with water.
3. Oil-soluble liquid forms solution when mixed with oil or deodorized kerosene.
4. Flowable (aqueous suspension)
  - a. Thick and creamy like a milkshake.
  - b. Mixed with water in spray tank.
  - c. Few need to be pre-mixed.
  - d. Forms suspension when mixed with water.
  - e. Needs continuous agitation to keep spray mixture even.

5. Fumigant (liquified gas)
  - a. Methyl bromide and Vikane® kept pressurized in container.
  - b. Chloropicrin and Telone® not pressurized.
  
6. Ready-to-use solutions
  - a. Aerosol can insecticides.
  - b. Brush-on insecticides.
  - c. Insecticides and herbicides in sprayer bottles and cans.



## **Sample Directions from Different Labels Showing the Same Ingredient and Different Formulations**

From the DIAZINON® 50W label:

### **ORNAMENTALS**

To control certain insects on ornamentals such as Arborvitae, Azalea, Birch, Boxwood, Camellia, Carnation, Chrysanthemum, Douglas Fir, Elm, Gladioli, Hawthorn, Holly Juniper, and Lilac apply the recommended rates indicated below.

From the DIAZINON® AG 500 label:

### **ORNAMENTAL INSECT CONTROL**

To control certain insects on Arborvitae, Azalea, Birch, Boxwood, Camellia, Carnation, Chrysanthemum, Douglas Fir, Elm, Gladioli, Hawthorn, Holly, Juniper, and Lilac apply the recommended rates indicated below.



## Formulation Identifiers

1. Common formulation identifiers:

FICAM W	W = <u>wettable</u> powder
BOTRAN 75W	75W = <u>75%</u> wettable powder
TRUBAN 5G	5G = 5% <u>granular</u>
PROXOL 80 SP	80 SP = 80% <u>soluble</u> powder
VERNAM 7E	E = <u>emulsifiable concentrate</u>
POUNCE 3.2 EC	EC = emulsifiable concentrate
FURADAN 4F	F = <u>flowable</u>
FICAM ULV	ULV = <u>ultra low volume</u>

2. Alternative formulation identifiers:

ORTHENE 75 S	75 S = 75% soluble powder
SEVIN 80S	80S = 80% sprayable
BRAVO 90DG	DG = dispersible granules
SOLICAM DF	DF = <u>dry flowable</u>
AATREX 4L	L = <u>liquid</u>
CARBAMATE WDG	Water dispersible granules

## Checklist for Section Two

### SLIDES

- \_\_\_ Pests
- \_\_\_ Insects and Mites

### AV EQUIPMENT

- \_\_\_ Overhead projector
- \_\_\_ Slide projector
- \_\_\_ Extension cords
- \_\_\_ Adaptors for 3-prong extension cords
- \_\_\_ Slide projector remote extension cord

## Weed Identification and Control

- DEFINE** Integrated Pest Management. See pp. 66-68.
- EXPLAIN** Weed Identification and Control. See p. 69.
- EXPLAIN** Two systems of classifying weeds. See pp. 70-71.
- DISCUSS** Common local weeds and sample label recommendations. See pp. 72-74.
- EXPLAIN** Weed Control. See pp. 75-76.
- EXPLAIN** Describing Herbicides. See pp. 77-81.

## **Insect Identification and Control**

<b>OVERVIEW</b>	Arthropods. See p. 82. Insect pests can be classified by the type of <u>life cycle</u> .
<b>COMPLETE METAMORPHOSIS</b>	Immatures and adults found in different locations. See p. 83.
<b>GRADUAL METAMORPHOSIS</b>	See p. 85.
<b>NO METAMORPHOSIS</b>	See p. 85.
<b>SLIDES</b>	Illustrate principle of classifying insects by type of damage they do.  (Notes for slides with slide carousel/tray.)
<b>EXPLAIN</b>	Methods of Insect Control. See pp. 86-87.
<b>EXPLAIN</b>	Mites handout. See pp. 88-90.

### NOTES FOR SLIDES ON WEEDS

1. A weed is any plant growing where you don't want it.
2. Example of a GRASS (Palm grass, Setaria palmifolia). Emphasize "parallel" leaf veins.
3. Example of a GRASS (Yellow foxtail, Setaria glauca). Emphasize "long, narrow" leaves.
4. Example of a GRASS (Vaseygrass, Paspalum urvillei). Some grasses grow in bunched, upright habit.
5. Example of GRASS (Bamboo). Emphasize "nodes" from which branches, roots may grow. Some grasses spread by rhizomes.
6. Example of GRASS (Swollen fingergrass, Chloris barbata).
7. Example of a GRASS (Radiate fingergrass, Chloris radiata).
8. Example of a GRASS (Napier grass or Elephant grass, Pennisetum purpureum).
9. Examples of a GRASS (California grass or Para grass, Brachiaria mutica).
10. Filler slide to separate GRASSES slides from SEDGES slides.
11. Comparison of GRASS (Hilo grass, Paspalum conjugatum) vs. SEDGE (Purple nutsedge, Cyperus rotundus) Sedges grow bunched upright.
12. Example of a SEDGE (White kyllinga, Cyperus kyllingia).  
Leaves subtending the flower head in group of three. Flower stalk is triangular in cross-section. Leaves are long and narrow and have parallel veins.
13. Example of a SEDGE (White kyllinga). Some sedges spread by rhizomes.
14. Same as #13.
15. Filler slide to separate SEDGES slides from BROADLEAVES slides.
16. Comparison of GRASS (Hilo grass) and BROADLEAF (Hilahila or sleeping grass).
17. Broadleaf plants have "netted" veins and broadleaves.

18. Example of a BROADLEAF (Wild bittermelon, Mormordica charantia var. pavel). Some broadleaves are reservoirs for viruses which cause diseases in crop plants; e.g. watermelon mosaic virus transmitted by aphids.
19. Example of a BROADLEAF (Tridax sp.)
20. Example of a BROADLEAF (Spanish needle, Bidens pilosa).
21. Example of a BROADLEAF (Clerodendron sp.) Some broadleaves grow into bushes.
22. Example of a BROADLEAF (Spanish clover, Desmodium uncinatum).
23. Example of a BROADLEAF (Koa haole, Leucaena Leucocephala). Some broadleaves grow into trees.
24. Example of a BROADLEAF (Creeping indigo, Indigo endecaphylla). Some broadleaves grow prostrate hugging the ground in lawns.
25. Example of a BROADLEAF (Broadleaf plantain, Plantago major). Some broadleaves grow in 'rosette' form (like lettuce).
26. Example of a BROADLEAF (Flora's paintbrush, Emilia sonchifolia). Reservoir for the spotted wilt virus; transmitted by thrips.
27. Example of a BROADLEAF (Hilahila or Sleeping grass, Mimosa pudica)
28. Example of a BROADLEAF (Pigweed, Portulaca oleracea). On the Mainland, it is called Purslane and another weed is called pigweed. Beware of common weed names printed on herbicide labels.
29. Example of a BROADLEAF (Yellow oxalis, Oxalis corniculata).
30. Comparison of a GRASS vs. a SEDGE vs. a BROADLEAF.
31. Example of Biological control of Lantana. Leaf damage by beetle, loss of leaves of stem tip. Other insects attack flowers and seeds.
32. Filler slide separating WEED slides from DISEASE slides.

Extra A: Clover in Centipede Grass lawn treated with selective herbicide.

Extra B: Close-up of Extra A.

## SLIDE ORDER FOR INSECTS AND INSECTICIDES

### INSECT WITH CHEWING MOUTHPARTS

1. Chinese Rose Beetle on Snap bean
2. Pepper Weevil
3. [White caterpillar with black dots] orange semi-circle on corner
4. *Hellula rogatalis*, Cabbage webworm on Chinese Cabbage
5. *Plutella xylostella*, Larvae on cabbage
6. Resting or Pupal Stage of Diamondback Moth, *Plutella xylostella* on Chinese Cabbage
7. Diamondback Moth, *Plutella xylostella*
8. Cutworm, "Above Hilo, Laplante" on corner
9. Sweet potato stem borer caterpillar
10. Corn Earworm (green)
11. Corn Earworm (brown)
12. *Cylas formicarius* [*elegantulus*]
13. *Euscepes postfasciatus*

### FLIES

14. Serpentine leafminer (*Liriomyza* sp.) and Beet armyworm on green onion leaf
15. Serpentine leafminer on Garden Bean
16. Pupa and Adult of Serpentine leafminer on Garden Bean
17. Serpentine leafminer adults on cucumber plants
18. Beanfly damage, Waimanalo, Oahu

### INSECTS WITH PIERCING-SUCKING MOUTHPARTS

19. [Drawing of mosquito head] Chapter 1-22
20. [Front view of Southern Green Stinkbug] 15
21. *Peregrinus maidis*, corn planthopper
22. Currant aphid 304-29
23. Aphididae [Aphids, dark brown]
24. 70-20 Cabbage aphid, *Brevicoryne* sp.
25. Greenhouse Whitefly, *Trialeurodes vaporariorum*

### INSECTS THAT CAUSE DAMAGE BY LAYING EGGS

26. Oriental Fruit Fly adult
27. 306-3 Tephretidae [Mediterranean Fruit Fly]

### OTHER ARTHROPOD PESTS

28. G 318-37, Pillbug, Isopoda: Asellidae
29. 143-17 Tick
30. 29 [Scorpion]
31. 89-3 Diplopoda [Millipede]

### MITES

32. Broad Mite, pepper
33. Carmine Spider mite
34. Spider Mite Damage

### SNAILS AND SLUGS

35. Slug--*Veronicella* on leaf
36. Giant African Snail

PLUS 12 MORE SLIDES ON "BIO-CONTROL" AGENTS, MOSTLY PREDATORS.

**SLIDES FROM "PESTS" SLIDE SET**

(Orange Label)

- 1 *Podocarpus* example of water-logging.
2. Tip-burn on new leaves of Pak Choy due to calcium deficiency or not enough water.
- 3 *Phytotoxicity*, young leaf deformed by malathion EC.
4. *Dracaena* sun burnt from over-exposure to full sun.
5. Fern-leaves burnt by car muffler.
6. Poinsettia: Banvel® phytotoxicity (upward cupping)
7. Papaya: Roundup® sprayed on green bark.
8. Banana: Velpar® sprayed on roadside.

**SECTION 2:  
PEST MANAGEMENT AND PESTICIDES**

**Integrated Pest Management  
Weed Identification and Control  
Insect Identification and Control  
Mites and Their Control  
Plant Diseases and Their Control**



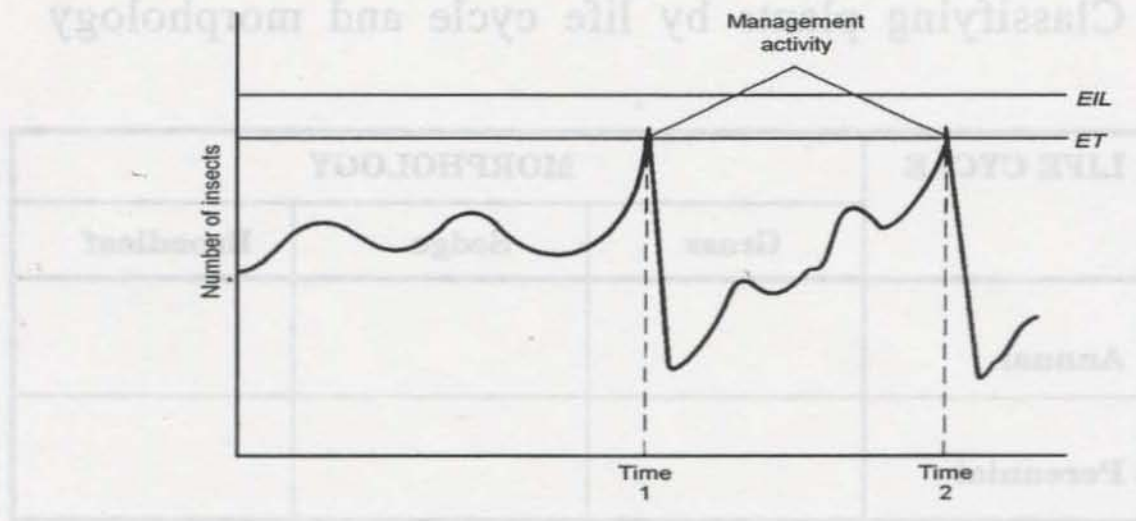
## Integrated Pest Management (IPM)

1. “Integrated” means coordinating the use of various pest control methods
  - a. Basic methods
    - i. Use of resistant plant varieties
    - ii. Good sanitation
    - iii. Cultural practices
    - iv. Encouraging natural enemies of pests
  - b. Supplemental methods
    - i. Pesticides
    - ii. Traps
    - iii. Hand weeding
    - iv. Mulches
  
2. “Management” means keeping pests at an acceptable level. The goal is not the complete removal of all pests.
  
3. IPM is a planned pest control program.

## Important Elements of an IPM Program

1. Correctly identify the problem
  - a. Sources of assistance
    - i. Universities and community colleges
    - ii. Department of Agriculture
    - iii. Private consultants
    - iv. Printed materials
  - b. A symptom may have more than one cause.
  - c. Example: Wilting may be caused by
    - i. Bacterial infection
    - ii. Fungal infection
    - iii. Heavy nematode infestation
    - iv. Not enough water
  
2. Study pests and beneficial organisms
  - a. Insect and crop life cycles and interactions.
  - b. Experience with one crop cycle will help with others
    - i. Evaluation
    - ii. Follow-up
  - c. Know the effects of weather and crop health upon pests and beneficial organisms.
  - d. Use scouting to determine the numbers of organisms in the fields.

3. Determine the economic threshold
  - a. Occurs when the cost of controlling the pest equals the cost of the pest damage.
  - b. Manager decides when to take action.



4. Prevent problems with chemical controls
  - a. Pests develop resistance to pesticides.
  - b. Secondary pest outbreak.
  - c. Pest resurgence.
  - d. Environmental contamination.
  - e. Possible long-term costs of spraying:
    - i. Public relations
    - ii. Liability
    - iii. Environmental problems
    - iv. Hazards to pesticide applicators and field workers.

## Weed Identification and Control

1. Weed
  - a. A plant out of place.
  - b. Any plant can be a weed if it is not wanted.
  
2. Classifying plants by life cycle and morphology

LIFE CYCLE	MORPHOLOGY		
	Grass	Sedge	Broadleaf
Annual			
Perennial			

3. Reasons for studying plant classification
  - a. To determine the best method of weed control.
  - b. Herbicide labels identify susceptible weeds by life cycle and morphology classification. (See examples on the following pages.)
  - c. Some herbicides control only certain types of weeds or control some types better than others.
  
4. Palms, lilies, ferns, and aquatic plants are classified according to a different system.

## Weed Classification by Life Cycle

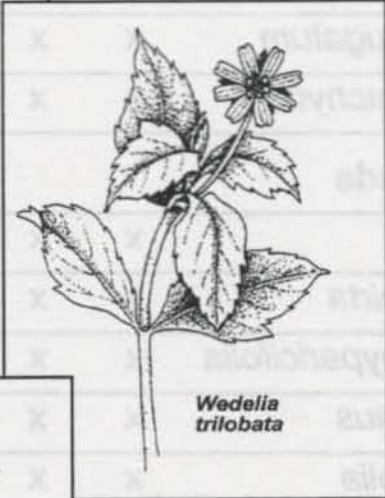
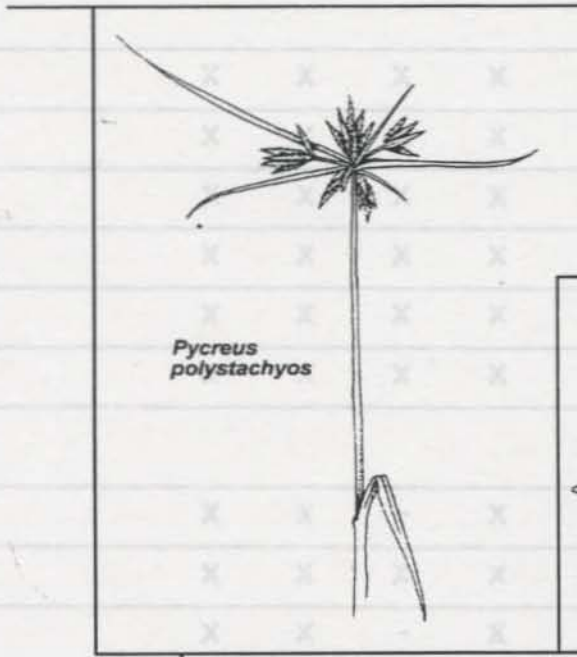
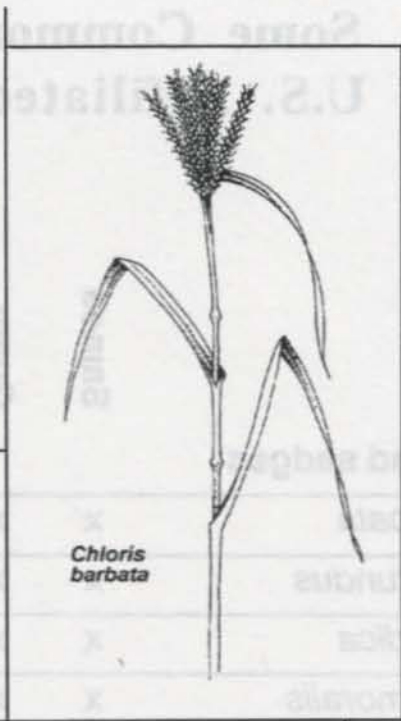
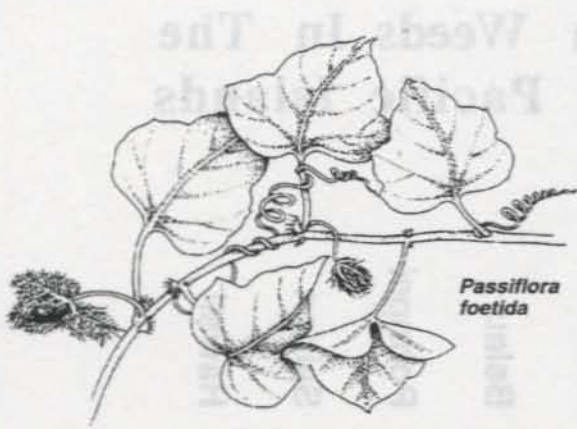
1. Annual weeds
  - a. Complete their life cycle, from seed, in less than 1 year.
  - b. Life cycles of annual weeds in tropical areas differ from those in temperate areas because temperatures are not low enough to kill weeds.
  
2. Perennial weeds
  - a. Live more than 2 years
  - b. Some reproduce by seed
  - c. Others reproduce vegetatively by:
    - i. Tubers
    - ii. Tap roots
    - iii. Rhizomes
    - iv. Stolons

## Weed Classification by Morphology

1. Based on partial botanical classification.
2. Grasses
  - a. Narrow leaves
  - b. Parallel veins
  - c. Flat or rounded stems
3. Sedge
  - a. Narrow leaves
  - b. Parallel veins
  - c. Three-angled stems
4. Broadleaf
  - a. Broad leaves
  - b. Netted veins
5. Weeds in the same morphology group respond to herbicides similarly.

## Some Common Weeds In The U.S. Affiliated Pacific Islands

	Samoa	Guam	Belau	Pohnpei	Saipan	Hawaii
<b>Grasses and sedges</b>						
<i>Chloris barbata</i>	X	X	X	X	X	X
<i>Cyperus rotundus</i>	X	X	X	X	X	X
<i>Eleusine indica</i>	X	X	X	X	X	X
<i>Kyllinga nemoralis</i>	X	X	X	X	X	X
<i>Paspalum conjugatum</i>	X	X	X	X	X	X
<i>Pycneus polystachyos</i>	X	X	X	X	X	X
<b>Broadleaf weeds</b>						
<i>Bidens alba</i>	X	X	X	-	X	X
<i>Chamaesyce hirta</i>	X	X	X	X	X	X
<i>Chamaesyce hypericifolia</i>	X	X	X	-	X	X
<i>Costus speciosus</i>	X	X	X	X	-	X
<i>Emilia sonchifolia</i>	X	X	X	X	X	X
<i>Ludwigia hyssopifolia</i>	X	X	X	X	-	X
<i>Mimosa pudica</i>	X	X	X	X	X	X
<i>Oxalis spp.</i>	X	X	X	X	X	X
<i>Passiflora foetida</i>	X	X	X	X	X	X
<i>Polygala paniculata</i>	X	X	X	X	-	X
<i>Stachytarpheta urticifolia</i>	X	X	X	-	X	X
<i>Wedelia trilobata</i>	X	X	X	-	-	X





## Sample Label Recommendations Based on Weed Morphology

1. Lasso<sup>®</sup> herbicide is recommended for control of yellow nutsedge and the annual grasses and broadleaf weeds listed in the WEEDS CONTROLLED section of this label.
2. Treflan<sup>®</sup> E.C. is a selective herbicide for the pre-emergence control of annual grasses and broadleaf weeds.
3. Velpar<sup>®</sup> is an effective general herbicide providing both contact and residual control of many annual and biennial weeds, woody plants, and most perennial weeds.

## Weed Control

1. Identify problem
  - a. Weed name
  - b. Life cycle: Annual, biennial, or perennial.
  - c. Morphology: Grass, sedge, or broadleaf.
2. Quarantine: Inspections and regulations.
3. Sanitation: Avoid introducing weed material in:
  - a. Soil, potting media, compost
  - b. Farm equipment.
  - c. Transplanting soil and potted plants
4. Cultural practices
  - a. Mulching
  - b. Transplanting vs. direct seeding
  - c. Close crop spacing
5. Physical-mechanical control
  - a. Hand pulling
  - b. Mowing and cutting
  - c. Tilling, plowing, disking, and hoeing
  - d. Burning

6. Biological control
  - a. Government agencies import, tests, and release natural enemies.
  - b. Usually large scale programs; rangelands, pastures, etc.
  - c. Expect reduction of weed stands, not eradication.
  - d. Example: Lantana.
  
7. Chemical control with herbicides.

## Describing Herbicides According to Spectrum of Control

1. Selective herbicides
  - a. Control or kill only certain weeds
  - b. Have little or no effect on other weeds and desirable plants if used properly.
  - c. Possible injury depending on weather and application technique.
  - d. Factors that affect selectivity
    - i. Difference between weed and crop (e.g., grass versus broadleaf plant).
    - ii. Proper placement of herbicide
    - iii. Proper timing of herbicide treatment.
  
2. Non-selective herbicides
  - a. Kill most plants.
  - b. Examples: Paraquat® and Roundup®.

## Directions for Selective Herbicides

1. From KARMEX<sup>®</sup> label:

PAPAYAS: Use only under trees established in the orchard for at least 1 year. Apply 2 1/2 to 5 lbs. per acre, preferably before weeds emerge. If weeds have emerged, add 1 pt. Surfactant WK per 25 gals. of spray.

2. From GOAL<sup>®</sup> 1.6E label:

GOAL<sup>®</sup> 1.6E is a selective herbicide for post-emergence application to direct-seeded and transplanted onions for early post-emergence control of certain broadleaf and grass weeds. Initial spray application should be made when the onions have two (2) fully developed true leaves. On onion transplants, spray as soon after transplanting as practical. GOAL<sup>®</sup> 1.6E herbicide can cause necrotic lesions, twisting, pigtailling or stunting of the onion plants. Injury will be more severe if applications are made during cool, wet weather and/or if applications are made prior to full development of two true leaves on onion plants.

## Describing Herbicides According to Movement in Plants

1. Contact herbicide
  - a. Usually kills only the portion of the weed that the herbicide contacts.
  - b. Surfactant in spray mixture enhances contact with treated plant surface.
  - c. Examples: Paraquat and weed oil.
  - d. Keep spray off desirable plants.

2. Translocated herbicide
  - a. Moves through plant (weed) after being absorbed by roots or foliage.
  - b. Examples
    - i. Roundup® and 2,4-D move to growing buds and roots when applied to leaves.
    - ii. AAtrex® and Karmex® are absorbed by the root system and translocated to the leaves when applied to the soil.

## Describing Herbicides According to Timing of Application

1. Preplant treatment
  - a. Applied before crop is planted.
  - b. Incorporation into soil.
  - c. Example: Eptam<sup>®</sup>.
2. Pre-emergence treatment
  - a. Applied before weeds emerge through soil surface.
  - b. Sometimes applied before crop emerges through the soil surface.
  - c. Read label directions to determine which meaning is appropriate.
  - d. Examples: Dacthal<sup>®</sup> and Ronstar<sup>®</sup>.
3. Post-emergence treatment
  - a. Applied after weeds emerge through the soil surface.
  - b. Sometimes applied after crop emerges through the soil surface.
  - c. Examples: Paraquat<sup>®</sup> and Roundup<sup>®</sup>.

## Timing Application Directions

From EPTAM® 7-E label:

### INCORPORATION DIRECTIONS:

Eptam® 7-E must be incorporated into the soil immediately to prevent loss of the herbicide. Whenever, possible, application and incorporation should be done in the same operation.

### SOIL MIXING (INCORPORATION) BEFORE PLANTING:

The following equipment is commonly used for soil mixing (incorporation) before planting: Power-driven cultivation equipment (recommended on all soil types) set to cut to depth of 2 to 3 inches, tandem discs, field cultivators, and rotary ground-driven or spring-tooth cultivators.

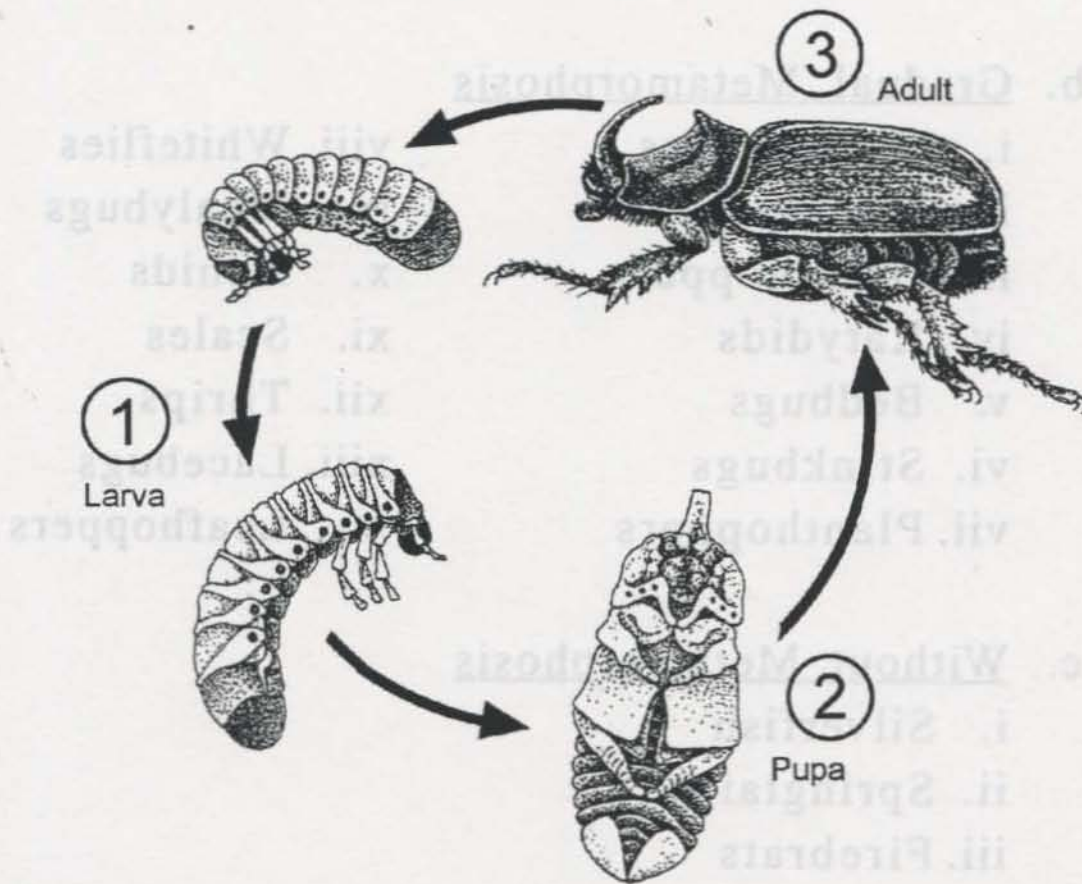


## Arthropods

1. Insects classified according to morphology
  - a. Complete Metamorphosis
    - i. Fleas
    - ii. Beetles
    - iii. Ants
    - iv. Flies and mosquitoes
    - v. Moths and butterflies
    - vi. Wasps and yellow-jackets
  - b. Gradual Metamorphosis
    - i. Cockroaches
    - ii. Crickets
    - iii. Grasshoppers
    - iv. Katydid
    - v. Bedbugs
    - vi. Stinkbugs
    - vii. Planthoppers
    - viii. Whiteflies
    - ix. Mealybugs
    - x. Aphids
    - xi. Scales
    - xii. Thrips
    - xiii. Lacebugs
    - xiv. Leafhoppers
  - c. Without Metamorphosis
    - i. Silverfish
    - ii. Springtails
    - iii. Firebrats
2. Centipides and millipedes.
3. Mites, ticks, and spiders.
4. Scorpions.

## Complete Metamorphosis

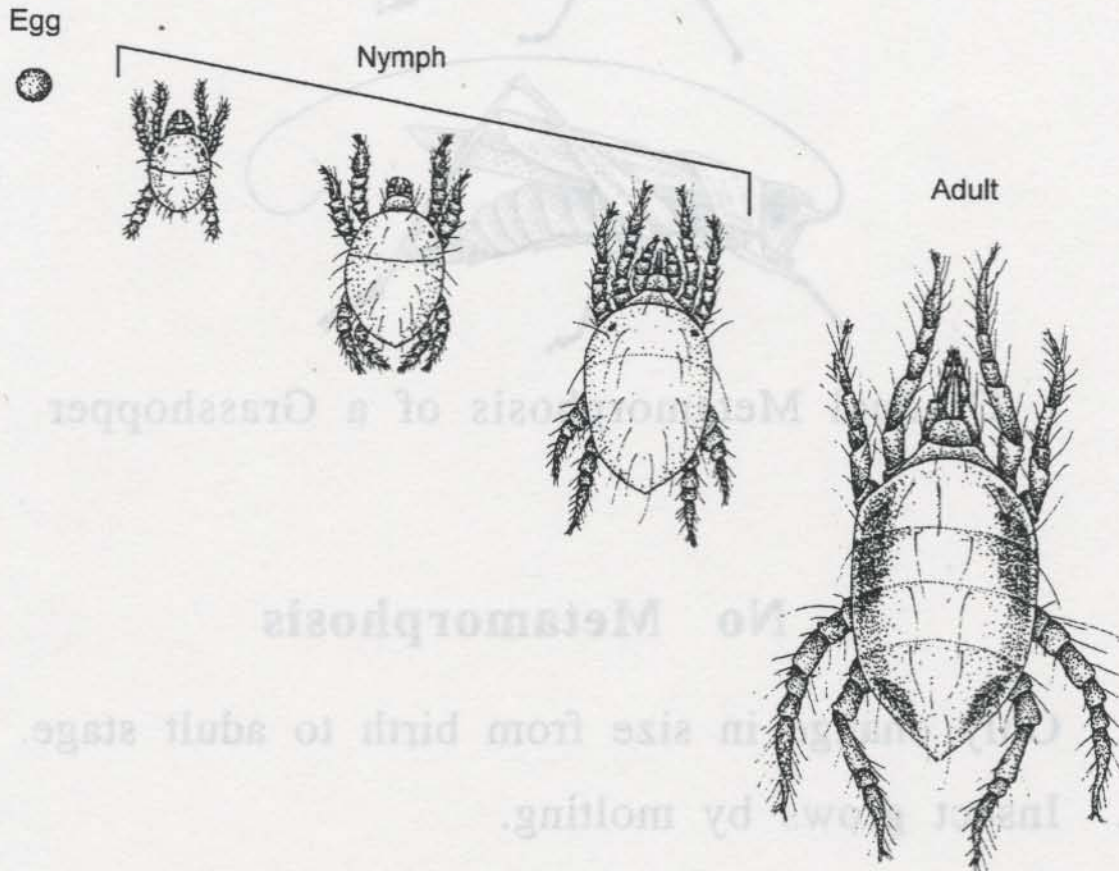
1. Four stages of development: Egg, larva (young), pupa and adult.
2. The young differ from adults in diet and habitat.
3. Examples: Beetles, moths, butterflies, mosquitoes, fleas, bees, wasps and ants.



Life Cycle of the Rhinoceros Beetle

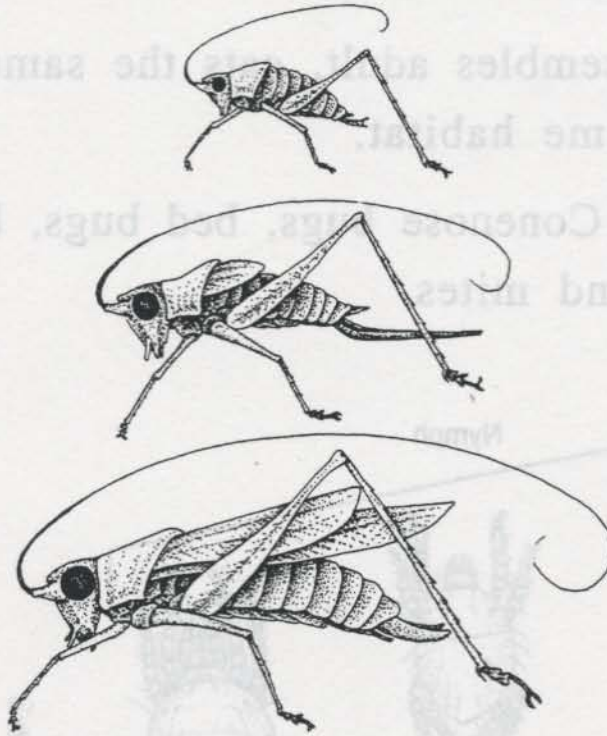
## Gradual Metamorphosis

1. Three stages of development: Egg, nymph (young), and adult.
2. Nymph resembles adult, eats the same food, and has the same habitat.
3. Examples: Conenose bugs, bed bugs, book lice, earwigs, and mites.



### Gradual Metamorphosis of a Mite

4. Gradual physical changes are more noticeable in winged species.
5. Examples: Grasshoppers, Cockroaches, and crickets.



Gradual Metamorphosis of a Grasshopper

### No Metamorphosis

1. Only change in size from birth to adult stage.
2. Insect grows by molting.
3. Food and habitat of the young are similar to those of the adult.
4. Examples: Silverfish, sucking lice and springtails.

## Insect Control

1. Quarantine
2. Sanitation
  - a. Remove crop residue after harvest.
  - b. Cover garbage containers to control house fly larvae.
3. Cultural practices
  - a. Trap crops
  - b. Example: Plant corn border around curcurbit crop to attract fruit flies, then spray corn to control pest.
4. Physical-mechanical control
  - a. Window screens.
  - b. Electric grid with black light. (Does not attract mosquitoes).
  - c. Sticky paste barrier (Tanglefoot).
  - d. Wide metal strip around coconut tree trunk to discourage rats.

5. Biological control
  - a. Government agency imports, tests, and releases natural enemies.
  - b. For large area; not usually for one specific farm.
  - c. Expect reduction of pest population until situation is tolerable; eradication is not the goal.
  - d. Example: Spiraling whitefly.
  
6. Chemical control (insecticides)
  - a. Stomach poisons
  - b. Contact
  - c. Systemic
  - d. Insect growth regulators (IGR)
  - e. Oils
  - f. Microbial (*Bacillus thuringiensis*)
  - g. Desiccants, silica aerogel (Dri-Die)
  - h. Fumigants
  - i. Soaps
  - j. Pheromones
  - k. Lures

## Mites

1. Mites are some of the most common arthropods
  - a. Most mites are beneficial.
  - b. Only small percentage are pests.
  - c. Some are natural enemies of other mites.
  
2. Life cycle
  - a. Gradual metamorphosis.
  - b. Egg—>larva—>nymph—>adult.
  - c. Some mites have several nymph stages.
  
3. Classification
  - a. Mites are not insects.
  - b. More closely related to spiders.
  - c. A tick is a type of mite.
  
4. Size
  - a. Smaller than most insects.
  - b. Range from microscopic to 1/50th inch.

5. Mites that feed on plants

a. "Piercing-sucking" mouthparts to feed on plant juices.

b. Examples: Broad mite, Carmine (Red) Spider mite, False spider mite (several kinds).

c. Signs of plant damage

i. Stippling: Feeding punctures cause small yellow to white dots .

ii. Scarring: Rough, brown to grayish-white scars from numerous microscopic feeding punctures in top layer of fruit skin. Damage occurs when fruit is young, healing produces scars.

iii. Deformed leaves: Mature leaves usually cupped downward and/or strap-like as if stretched lengthwise. Caused by damage to immature soft leaves.



6. Mites that feed on animals
  - a. Fowl mites suck blood from chickens.
  - b. *Sarcoptes scabiei* causes Sarcoptic mange (“scabies”) and lives in outer dry layer of skin.
  - c. *Demodex spp.*
    - i. Causes typical mange in which hair falls out and red inflamed patches form on skin.
    - ii. Most dogs have *Demodex* mites in hair follicles below skin surface but few develop mange.\*
  
7. Miticides
  - a. Will not harm beneficial insects and mites if used properly.
  - b. Examples: Vendex®, Plictran®, Omite®, Pentac®, and wettable sulfur.
  
8. Insecticides
  - a. Most insecticides kill mites.
  - b. Non-selective insecticides will harm beneficial insects and mites.

\* Interview with M. L. Goff, 9/86.

## Plant Diseases

1. Plant disease
  - a. Condition of abnormal plant growth.
  - b. Caused by continuous irritation.
  - c. Can affect any plant part, even in storage, e.g. papaya in shipping containers.
2. Infectious (biotic) diseases: Pathogens are living and can be transmitted.

- a. Viruses

- i. Invade plant cells and become part of them.
- ii. Spread by people, aphids, thrips, etc.
- iii. Symptoms and hosts

Ring spot	Papaya
Mosaic	Papaya, cucumber
Puckering	Cucumber
Stunting	Corn
Decline	Citrus
- iv. Example: Bunchy Top Disease

- b. Mycoplasmas and spiroplasmas

c. Bacteria

- i. Spread by water hoses, tools, cuttings, seeds, soil, splashing water.
- ii. Symptoms: Soft rot, wilt systemic in water-conducting tissue, water-soaked leaf spot.

d. Fungi

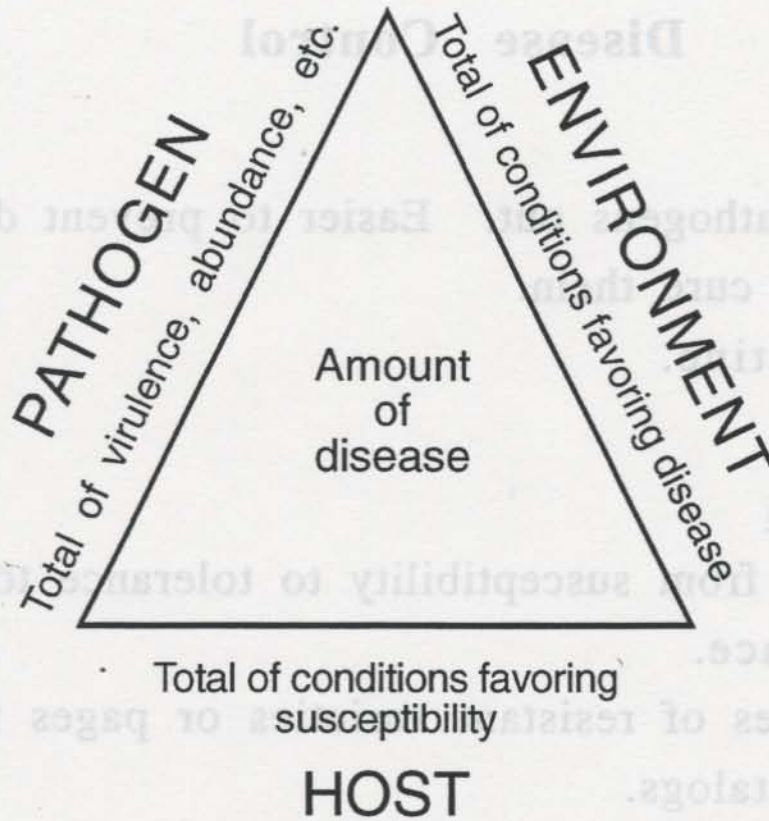
- i. Spread by people, insects, airborne spores.
- ii. Symptoms: Rust spots, wilt, leaf spots, streaks, smut, canker, damping off, mildew.

e. Nematodes

- i. Microscopic worms that suck sap from roots and leaves; burrow into roots and banana corms.
- ii. Symptoms: Wilt, root knots, poor nutrient absorption due to damaged root system.

f. Parasitic angiosperms (flowering plants)

3. Non-infectious (abiotic) diseases: Non-living agents that cannot be transmitted.
  - a. Air pollution
    - i. Causes leaf spots in susceptible plants.
    - ii. Problematic during smog inversion.
  - b. Man-made chemicals
    - i. Excess fertilizing kill roots and leads to fungus invasion.
    - ii. Herbicide damage.
    - iii. Other phytotoxic symptoms.
  - c. Poor nutrition
    - i. Calcium deficiency causes blossom end rot of tomato fruits before harvest.
    - ii. Excess nitrogen increases susceptibility.
4. Disease triangle: Three elements necessary for disease development, any of which may be changed to prevent or slow down disease.
  - a. Host is the susceptible plant
    - i. Bananas are susceptible to leaf streak diseases.
    - ii. Resistant snap bean varieties do not develop bean rust fungus.



- b. Pathogen is the disease-causing agent
  - i. Bunchy top: Viral pathogen of bananas and is spreading throughout Pacific Islands.
  - ii. Lethal Yellows affects coconuts.
- c. Environment may favor disease development e.g. During rainy weather there is more fungal disease on bananas and other crops.

## Disease Control

1. Exclusion
  - a. Keep pathogens out. Easier to prevent diseases than to cure them.
  - b. Quarantine.
2. Resistance
  - a. Ranges from susceptibility to tolerance to total resistance.
  - b. Examples of resistant varieties or pages from seed catalogs.
3. Cultural practices
  - a. Make environment unfavorable for disease development.
  - b. Good soil drainage reduces root rot.
  - c. Raised planting beds control damping off.
  - d. Drip irrigation instead of sprinkling keeps leaves dry.
  - e. Careful irrigation provides sufficient water for plants while limiting soil-borne disease.
  - f. Proper row spacing improves air circulation and controls white rust on daikon and mustard cabbage.

4. Eradication

- a. Total elimination difficult to accomplish; reduce amount of inoculum instead.
- b. Rotate crop with non-susceptible crop.
- c. Practice good sanitation: Clean equipment, dip cutting tools and pots, keep water hoses off ground.
- d. Kill vectors and remove infected plants.
- e. Eliminate or reduce weed reservoirs and alternate hosts, perhaps with herbicides.
- f. Soil fumigation and steam sterilization (pasteurization).

5. Chemical control

- a. Systemic: Benlate and Ridomil.
- b. Non-systemic (protectant): Maneb, Zineb, Mancozeb, copper fungicides.

## **Checklist For Section Three**

### **SLIDES**

- Pesticide Application Equipment
- How to Handle Chemical Spills

### **AV EQUIPMENT**

- Overhead projector
- Slide projector
- Adaptors for 3-prong extension cords
- Extension cords
- Slide projector remote extension cord

### **ADDITIONAL ITEMS**

- Tape measure
- Stakes (4)
- Graduated cylinder
- Knapsack sprayer
- One-gallon pitcher (optional)
- Calculator



## Application Methods

**EXPLAIN** Meaning of terms used to describe methods of application. These terms are used in the instructions printed on pesticides labels. The explanations we give you may not be exactly the same as those on your pesticide label, so be sure double check. See pp. 98-100.

## Application Equipment

**EXPLAIN** Advantages and disadvantages of different type of application equipment. See pp. 101-102,

**SLIDES** Slide/tape program: Pesticide Application Equipment. Alert trainees to pay attention to the advantages and disadvantages of equipment.

**DISCUSS** Main parts of canister, hose-end, backpack, and tank sprayers. See pp. 103-105.

**REVIEW** Nozzles. Slide set, Focus on Nozzles, (20 minutes).

## Calculations and Problem Solving

**HANDOUT & DISCUSS** Items #1 and #2 of handout, "Direction for Mixing Pesticides." See p. 106.

**DISCUSS** Item #3. Discuss three ways to adjust sprayer output (gallons per acre):

1. Pressure: If you raise the pressure, will you increase or decrease the gallons per acre?
2. Speed of travel: If you slow down, will you increase or decrease the gallons per acre?
3. Size of nozzle tip orifice: If you use a nozzle tip with larger openings, will you increase or decrease the gallons per acre?

**DISCUSS** Item #4, See p. 108.

**EXPLAIN** "Calculating the Strength of a Small Spray Mixture." These are sample calculations you may follow when you need to do dilution calculations for amounts of spray mixture that are more (or less) than the volume shown on the label directions. See pp. 109-114.

**DISCUSS** "Sprayer Calibration." What calibration means and how calibration can benefit the pesticide user. See p. 115.

**DISCUSS** "Calibration Worksheet." See pp. 118-119.

"Before we go outside to demonstrate how to calibrate this backpack sprayer, let's review the things we will be doing."

Read aloud the 7 steps on the worksheet. After you read step 3, ask someone with a stop watch to do the timing.

"Take this worksheet outside with you so you can write down the measurement we'll be making. Then we'll come back into the classroom and do the calculations."

**DEMONSTRATE** Calibration of backpack sprayer. Follow 7 steps described on worksheet.

**DISCUSS** Dosage Calculation Example." See pp. 120-121. This is a sample calculation you may follow when you need to follow dosage directions. Assume that you know the following:

1. Sprayer tank size.
2. Area of the target site.
3. Calibrated "gallons per acre" for the sprayer.

Point out that of the 4 items of information (tank size, field size, gallons per acre, and label directions), calibration only give you 'gallons per acre'.

## Spills and Fires

**DISCUSS** "Material Safety Data Sheet (MSDS)." See p. 127.

"Until now, I have talked about the importance of the pesticide label. Now I want to discuss another type of printed information called the Material Safety Data Sheet or MSDS."

**DISCUSS** The parts of an MSDS. Use the Gramoxone MSDS. See pp. 128-130.

"Look at sections 1-3. They discuss the product name, hazard summary, ingredients, and physical data. Section IV describes what to do in case of a fire. (Read the text.) Section VII describes what to do in case of a spill. (Read the text.) Section VIII describes what kind of protective clothing or equipment you should wear when handling this pesticide." (Read the text and mention that some of this information also appears on the label.)

**DISCUSS** "Reporting Requirements." See pp. 131-132. Do this exercise in class.

"To answer some of the questions, you need to use the information in 'Pesticides and SARA' on pages 133-137. Do the exercise on your own or with somebody else but write down the answers in your own workbook."

Allow 15-20 minutes for the exercise then give and discuss the answers. This can also be used as a take-home exercise.

**SLIDES** "How to Handle Chemical Spills."

This slide set is not current. Where the narrator recommends that you call CHEMTREC, remember that you are obligated to notify the agencies listed in the leaflet, "Pesticides and SARA."

**DISCUSS** "Fires Involving Pesticides." See pp. 128-139.

**SECTION 3:  
APPLICATION METHODS AND EQUIPMENT**

**Methods of Application  
Selection and Care of Application Equipment  
Calculations and Problem Solving  
Calibration Demonstration  
Spills and Fires**

## Application Methods

**BAND:** Application to a strip over or beside a crop row.

**BASAL:** Application to stems or trunks at ground level.

**BROADCAST:** Uniform application to an entire specific area.

**CHEMIGATION:** Application through an irrigation system.

**CRACK AND CREVICE:** Application in cracks and crevices where pests live.

**DIP:** Complete or partial immersion of a plant, animal, or object in a pesticide.

**DIRECTED:** Aiming the pesticide at a portion of a plant, animal, or structure.

**DRENCH:** Soaking the soil with a pesticide, or treating an animal orally with a liquid pesticide.

**FOLIAR:** Application to the leaves and stems of a plant.

**FUMIGATION:** Surrounding the object to be treated with a gaseous form of pesticide.

**INCORPORATION:** Mixing the pesticide into the soil.

**IN-FURROW:** Application into the soil opening in which a plant is planted.

**INJECTION:** Application beneath the surface of the soil or into a plant.

**OVER-THE-TOP:** Application over the top of a growing crop.

**POUR-ON:** Pouring the pesticide along the mid-line on the back of livestock.

**SIDE-DRESS:** Application along the side of a crop row.

**SOIL APPLICATION:** Application to the soil instead of the plants.

**SPOT TREATMENT:** Application to a small area. For indoor insecticides, not more than 2 square feet.

## Sample Incorporation Directions

From the EPTAM® 7-E label:

EPTAM® 7-E must be incorporated into the soil immediately to prevent loss by evaporation of the herbicide. Whenever possible, application and incorporation should be done in the same operation.

**SOIL MIXING (INCORPORATION) BEFORE PLANTING:** The following equipment is commonly used for soil mixing (incorporation) before planting:

Power-driven cultivation equipment  
(recommended on all soil types) set to cut to a  
depth of 2 to 3 inches.

Tandem discs

Field cultivators

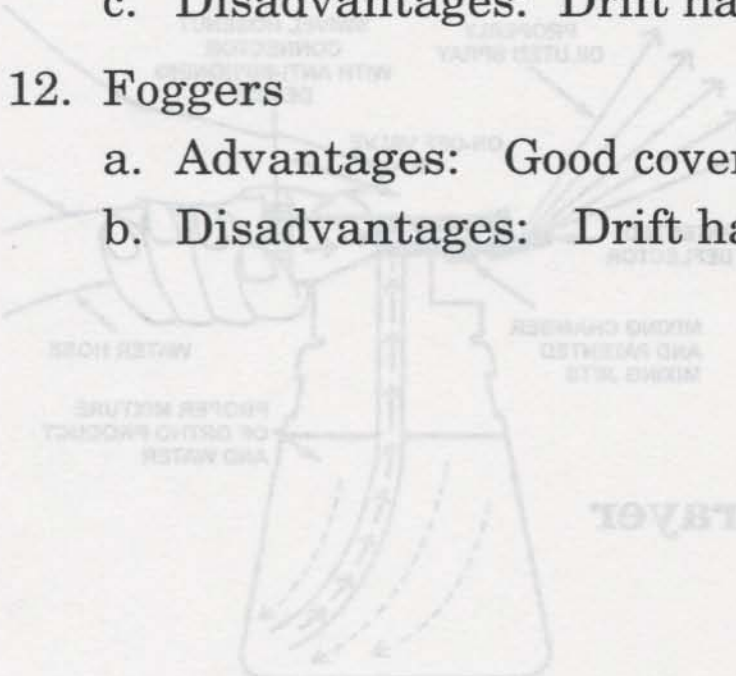
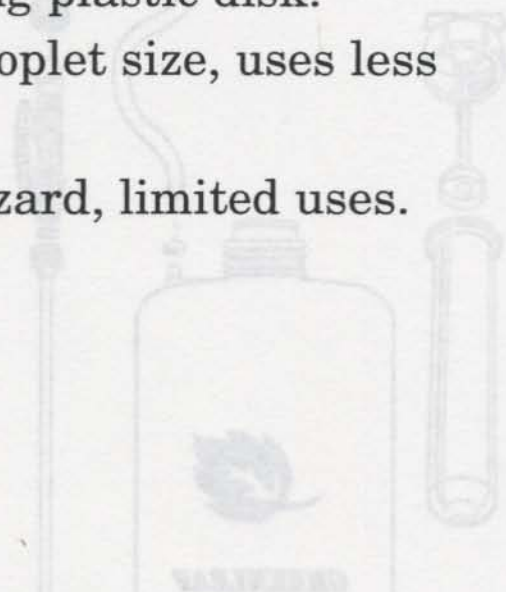
Rotary ground-driven or spring-tooth  
cultivators.

## Application Equipment for Liquid Pesticides

1. Hose-end sprayer
  - a. Advantages: Easy to use and clean, inexpensive.
  - b. Disadvantages: Must have an air gap or reduced pressure valve in the water supply line, no agitator.
2. Hand-pump sprayer
  - a. Advantages: Easy to use and clean, inexpensive.
  - b. Disadvantages: Too small for large areas.
3. Knapsack (backpack) sprayer
  - a. Advantage: Maneuverable.
  - b. Disadvantages: No agitator, may spill from hole in cover, uniform coverage is difficult.
4. Mist blower
  - a. Advantages: Good coverage, maneuverable, can apply beyond the reach of a knapsack.
  - b. Disadvantages: Drift hazard, no agitator.
5. Wick (swabbing) applicator
  - a. Herbicide-soaked carpet, sponge, or rope is wiped onto weeds.
  - b. Advantages: No drift hazard, uses less herbicide.
  - c. Disadvantages: Only used with some translocated herbicides, hard to calibrate.

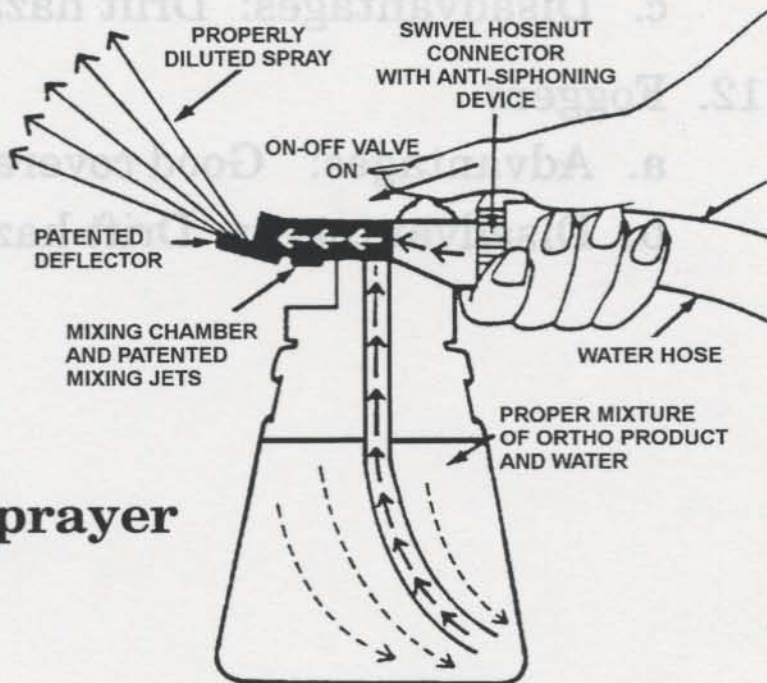


6. Herbi<sup>®</sup> (Controlled droplet applicator)
  - a. Droplets spun off spinning plastic disk.
  - b. Advantages: Uniform droplet size, uses less herbicide.
  - c. Disadvantages: Drift hazard, limited uses.
7. Low-pressure field sprayer
8. High-pressure sprayer
9. Air-blast sprayer
10. Ultra-low-volume sprayer
11. Aircraft
  - a. Airplane (fixed wing) or helicopter (rotary wing).
  - b. Advantages: Covers large areas quickly.
  - c. Disadvantages: Drift hazard.
12. Foggers
  - a. Advantages: Good coverage.
  - b. Disadvantages: Drift hazard.



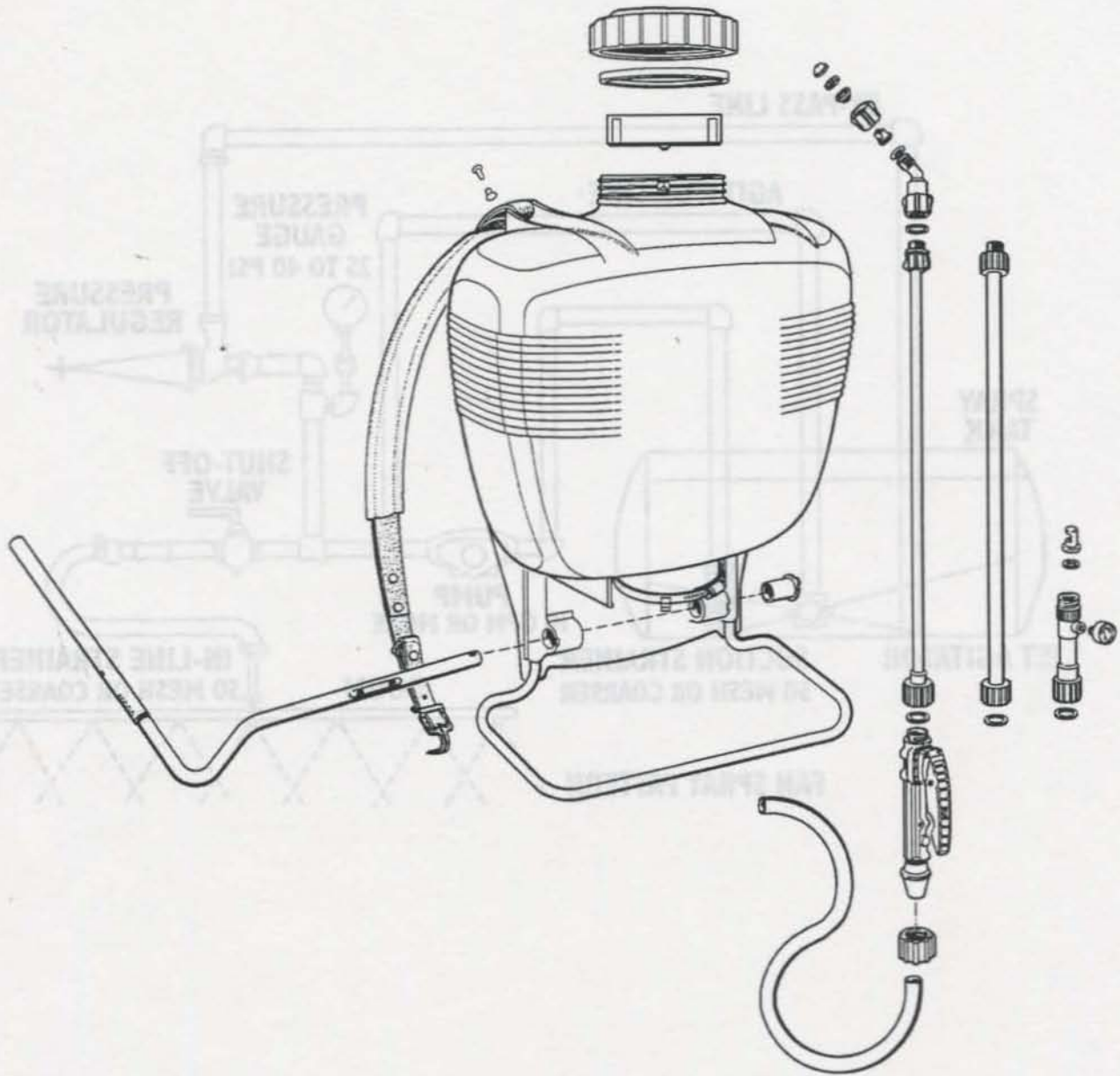


## Canister Sprayer

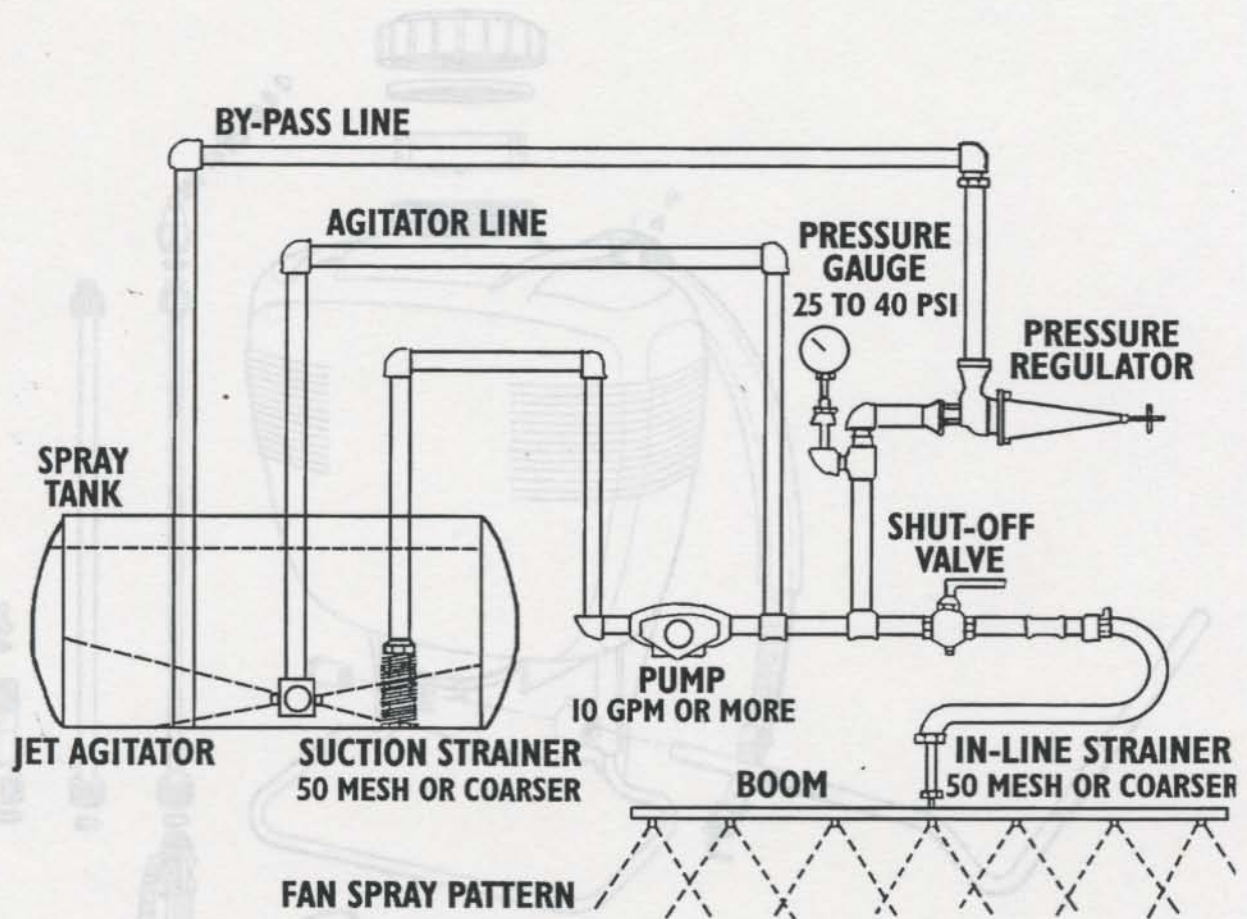


## Hose-End Sprayer

# Backpack Sprayer



# Tank Sprayer



## Directions for Mixing Pesticides

### 1. Dilution Directions:

Specify the strength of the spray mixture.

It is a misuse to apply a stronger mixture.

### 2. Dosage Directions:

Specify how much pesticide to apply per acre.

It is a misuse to apply more than the allowable amount per acre.

*Pentac® WP should be mixed at the rate of 8 ounces (by weight) per 100 gallons of water.*

Do not make a spray mixture of 10 ounces per 100 gallons of water.

*Use the following recommended rate of Phoskil® 25 WP in sufficient water to thoroughly cover 1 acre. Eggplant: Use 2 pounds per acre.*

Do not apply 3 pounds of Phoskil® per acre of eggplants.

**3. Dosage directions with dilution limit:**

Specify amount of pesticide per acre and strength of mixture.

It is a misuse to apply a stronger mixture.

It is a misuse to apply more than the allowable amount per acre.

*Pour the recommended amount of Eptam® 7-E into the spray tank during the filling operation. Apply in 10 to 50 gallons of water per acre using a properly calibrated, low-pressure sprayer. Crop X: Use 2 qt. per acre.*

Do not make an Eptam® mixture of 2 qt. per 8 gallons of water and apply all of this mixture to 1 acre of crop X.

Do not make an Eptam® mixture of 3 qt. per 75 gallons of water and apply all of this mixture to 1

#### 4. Dilution Directions with Dosage Limit:

Specify the strength of the spray mixture and the quantity of pesticide that may be applied per acre.

*For papaya use 4 to 8 ounces of Vendex® 50WP per 100 gallons of spray. Do not apply more than 400 gallons of dilute spray per acre. (Max. dosage allowed is 32 oz. per acre.)*

It is a misuse to apply a stronger mixture.

Do not treat 1 acre with 200 gallons of spray mixture made by mixing 16 ounces Vendex® per 100 gallons of water.

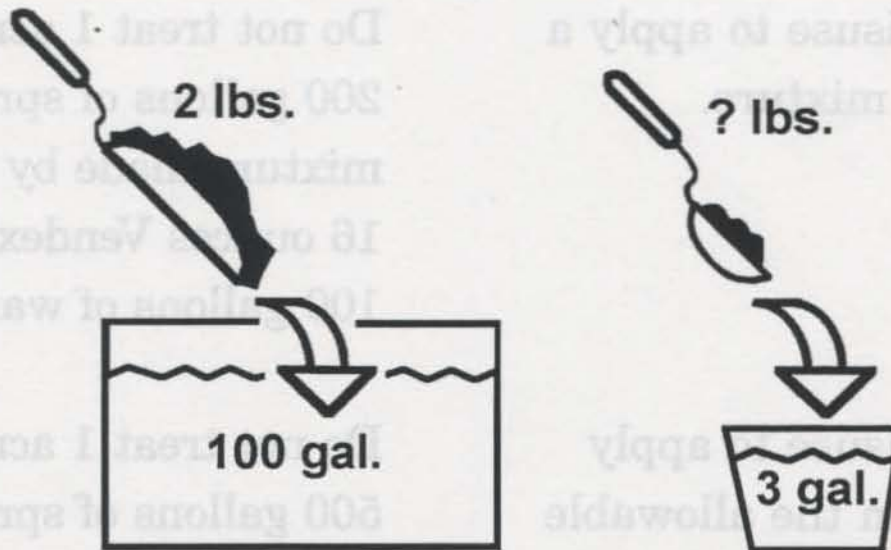
It is a misuse to apply more than the allowable amount per acre.

Do not treat 1 acre with 500 gallons of spray mixture made by mixing 8 ounces Vendex® per 100 gallons of water.

Note: Learn to estimate how much mixture you need. If you make too little, you leave the job undone or waste time making more. If you make too much, you must legally dispose of the excess and you waste whatever you don't use.

## Calculating the Strength of a Small Spray Mixture

Problem: The label directions say to apply a mixture of 2 lbs. pesticide per 100 gallons of water but you only need 3 gallons of mixture for a knapsack sprayer.



How much pesticide should you mix in 3 gallons of water to get a spray mixture of the same strength as 2 pounds of pesticide in 100 gallons of water?



Answer:

$$\frac{2 \text{ lb.}}{100 \text{ gal.}} = \frac{X}{3 \text{ gal.}} \quad (\text{Cross multiply.})$$

$$X = \frac{2 \text{ lb.} \times 3 \text{ gal.}}{100 \text{ gal.}}$$

$$X = \frac{6 \text{ lb.}}{100}$$

$$X = .06 \text{ lb.}$$

You should mix .06 pounds of pesticide in 3 gallons of water to get the same strength spray mixture as 2 pounds of pesticide in 100 gallons of water.

## Using a Scale

**Problem:**

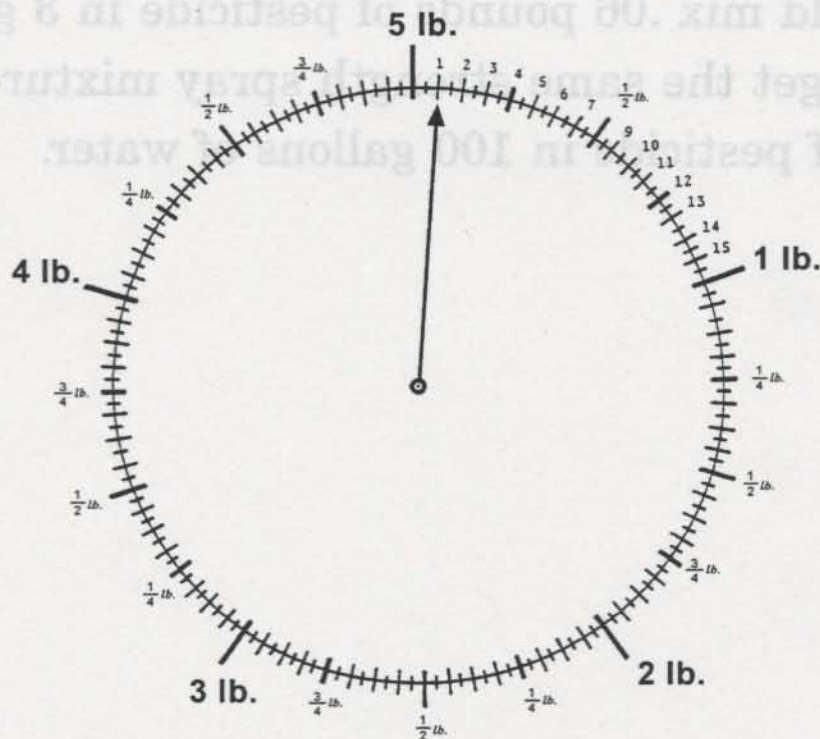
The answer to the previous cross multiplication problem is .06 pounds. You must use a scale marked in pounds and ounces to weigh the pesticide. How do you weigh out .06 lb?

**Answer:**

.06 lb. x 16 ounces per pound = .96 oz.

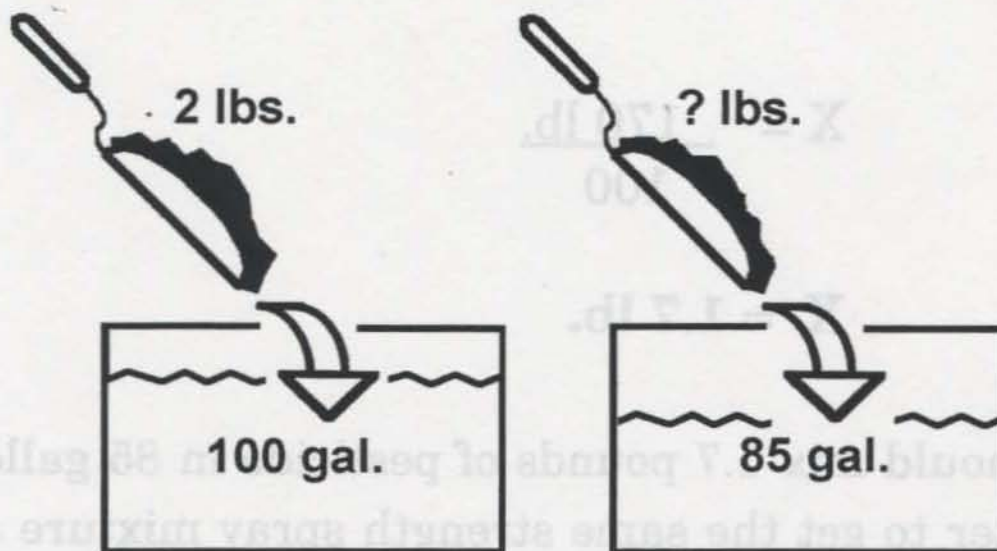
You should weigh out approximately 1 ounce of pesticide to use in the 3-gallon spray mixture.

### Five Pound Scale Face



## Calculating the Strength of a Large Spray Mixture

Problem: The label directions say to apply a mixture of 2 lbs. pesticide per 100 gallons of water but you only need 85 gallons of mixture for a tank sprayer.



How much pesticide do you mix in 85 gallons of water to get a spray mixture of the same strength as 2 pounds of pesticide in 100 gallons of water?

Answer: *Calculating the Strength of a*

$$\frac{2 \text{ lb.}}{100 \text{ gal.}} = \frac{X}{85 \text{ gal.}} \quad (\text{Cross multiply.})$$

$$X = \frac{2 \text{ lb.} \times 85 \text{ gal.}}{100 \text{ gal.}}$$

$$X = \frac{170 \text{ lb.}}{100}$$

$$X = 1.7 \text{ lb.}$$

You should mix 1.7 pounds of pesticide in 85 gallons of water to get the same strength spray mixture as 2 pounds of pesticide in 100 gallons of water.

## Using a Scale

**Problem:**

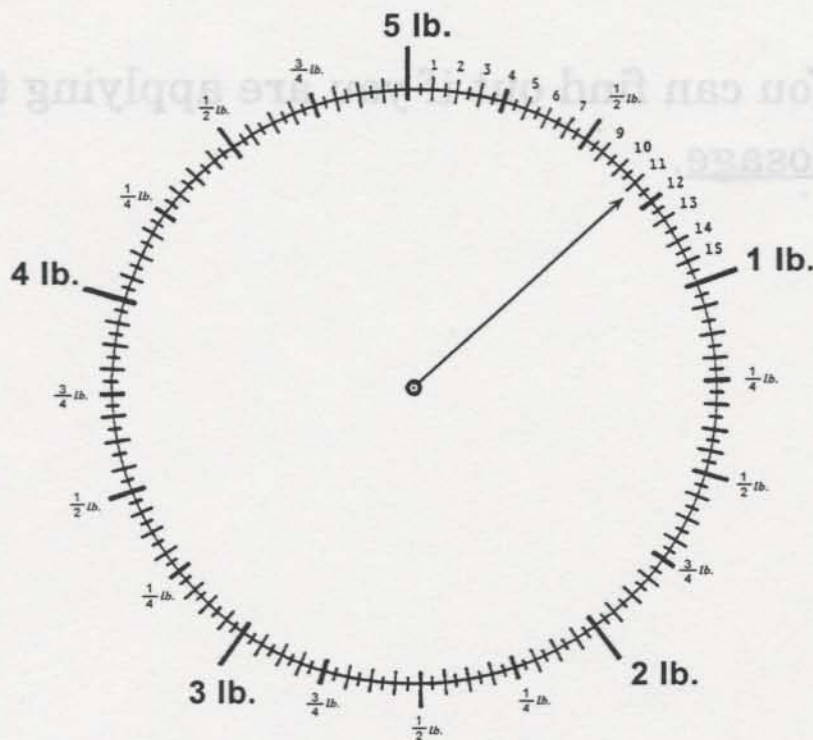
The answer to the previous cross multiplication problem is 1.7 pounds. You must use a scale marked in pounds and ounces to weigh the pesticide. How do you weigh out 0.7 lb?

**Answer:**

$$0.7 \text{ lbs.} \times 16 \text{ ounces per pound} = 11.2 \text{ ounces.}$$

You should weigh out 1 pound plus 11 ounces of pesticide to use in the 85-gallon spray mixture.

### Five Pound Scale Face



## Sprayer Calibration

1. Calibrating your sprayer means:
  - a. Knowing how many gallons of spray mixture you and your sprayer apply per acre.
  - b. Adjusting your sprayer or yourself to apply the correct amount of spray mixture per acre. (Some labels list the amount per 100 square feet, per 1000 square feet, or per 10 linear feet.)
2. Importance of calibrating your sprayer
  - a. You can estimate how much spray mixture you need for a job.
  - b. You can find out if you are applying the correct dosage.

## Sample Dosage Directions

### Example #1:

Established bermuda grass and zoysia grass: Mix 1 to 2 fluid ounces (2 to 4 tablespoons) of *BUENO 6* in 5 gallons of water *per 1,000 square feet*.

### Example #2:

DILUTION TABLE FOR WEED-B-GONE

Area to Treat	Water to Use	Amount of WEED-B-GONE*
200 sq. ft.	1 gallon	4 tsp.
1200 sq. ft.	6 gallons	8 Tbsp. (4 oz.)

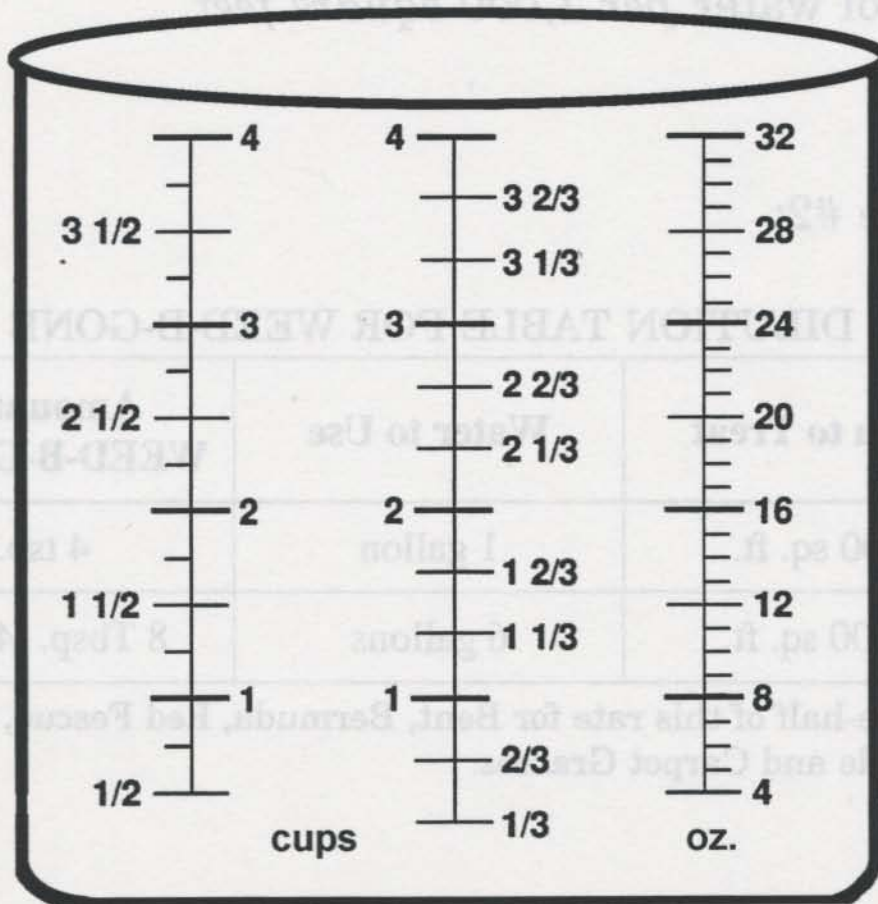
\*Use one-half of this rate for Bent, Bermuda, Red Fescue, Centipede and Carpet Grasses.

### Example #3:

Use a 0.5% emulsion for subterranean termites. Mix 2 gallons of *TORPEDO* in 98 gallons of water. Vertical barriers: Apply the emulsion at the rate of 4 gallons *per 10 linear feet per foot of depth*.

Sample Dosage Directions

# Measuring Volume





## Calibration Worksheet

Use only water when calibrating.

1. Clean nozzles, filters, screens, and tank. Fix leaks and make sure equipment is operating properly. If spraying with a boom, check for proper spray pattern overlap.
2. Fill tank with plain water. Operate sprayer at the desirable pressure. Consider coverage and drift control. Record the gauge pressure. \_\_\_\_\_ p.s.i.
3. While operating the sprayer at the proper gauge pressure, use a container to collect water from the nozzles for 10 seconds. Record the amount of water collected. \_\_\_\_\_ fl. oz.  
Repeat the above procedure. \_\_\_\_\_ fl. oz.  
Repeat it again. \_\_\_\_\_ fl. oz.  
Calculate the average. \_\_\_\_\_ fl. oz.

4. Convert average ounces/second to \_\_\_\_\_ gal/min  
gallons per minute.

5. Hand sprayers

Measure and mark out an area to be sprayed. Record the size. \_\_\_\_\_ sq. ft.

Time yourself or have someone time you. Spray the area at your usual pace using the pressure noted earlier. Record how many seconds it takes to spray the area. \_\_\_\_\_ sec.

Repeat the above procedure. \_\_\_\_\_ sec.

Repeat it again. \_\_\_\_\_ sec.

Calculate the average time. \_\_\_\_\_ sec.

6. Convert average seconds/square foot to minutes per acre. \_\_\_\_\_ min/acre

7. Multiply gallons/minute X minutes/acre to find gallons per acre. \_\_\_\_\_ gal/acre

## Dosage Calculation Example

The following information is known:

Backpack tank size: 4 gallons.

Field size: Your field of eggplants is 0.5 acre.

Gallons per acre: By calibrating your sprayer, you find that you use 90 gallons of spray mix per acre.

Label directions: "For eggplant, use 3 pounds per acre in sufficient water to thoroughly cover 1 acre."  
(This is a dosage type of direction.)

Use the above information to answer the following questions:

1. How many gallons of spray mix do you need to treat your entire field?

$$90 \text{ gal/acre} \times 0.5 \text{ acre/field} = \mathbf{45 \text{ gal/field}}$$

You need 45 gallons of spray mix to treat your half-acre eggplant field.

2. How much pesticide should you measure out for 1 full tank (4 gallons)?

$$\frac{3 \text{ lb.}}{\text{acre}} \times \frac{\text{acre}}{90 \text{ gal.}} \times \frac{4 \text{ gal.}}{\text{tank}} = \frac{0.133 \text{ lb.}}{\text{tank}}$$

$$\frac{0.133 \text{ lb.}}{\text{tank}} \times \frac{16 \text{ Oz.}}{\text{lb.}} = \underline{\mathbf{2.13 \text{ oz.}}}$$

You need about 2 1/8 oz. of pesticide to make a full backpack tank of spray mix.

3. How much pesticide do you need for another 41 gallons of spray mix to finish the job?

$$\frac{3 \text{ lb.}}{\text{acre}} \times \frac{\text{acre}}{90 \text{ gal.}} \times \frac{41 \text{ gal.}}{\text{rest of field}} = \frac{1.37 \text{ lb.}}{\text{rest of field}}$$

$$\frac{1.37 \text{ lb.}}{\text{rest of field}} \times \frac{16 \text{ oz.}}{\text{lb.}} = \underline{\mathbf{21.9 \text{ oz.}}}$$

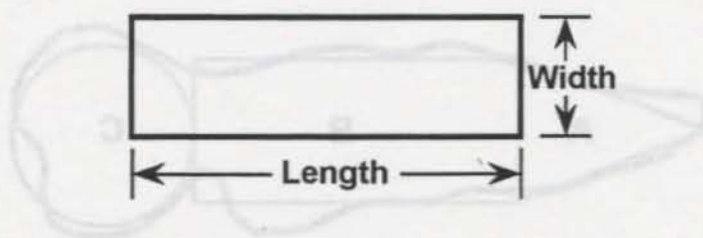
You need about 22 oz. of pesticide to make another 41 gallons spray mix to spray the rest of the field.

## Area of Regularly-Shaped Fields

To determine how much pesticide you need to treat a field, you must measure the area of the field.

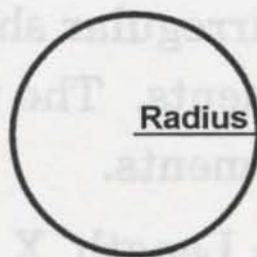
**Rectangular field:** Multiply the length times the width.

$$\text{Area} = \text{Length} \times \text{Width}$$



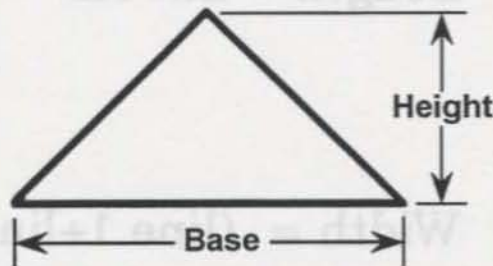
**Circular field:** Multiply 3.14 times the radius (one half the diameter) squared.

$$\text{Area} = 3.14 \times (\text{radius})^2$$



**Triangular field:** Multiply one-half the base times the height.

$$\text{Area} = 1/2 \text{ Base} \times \text{Height}$$

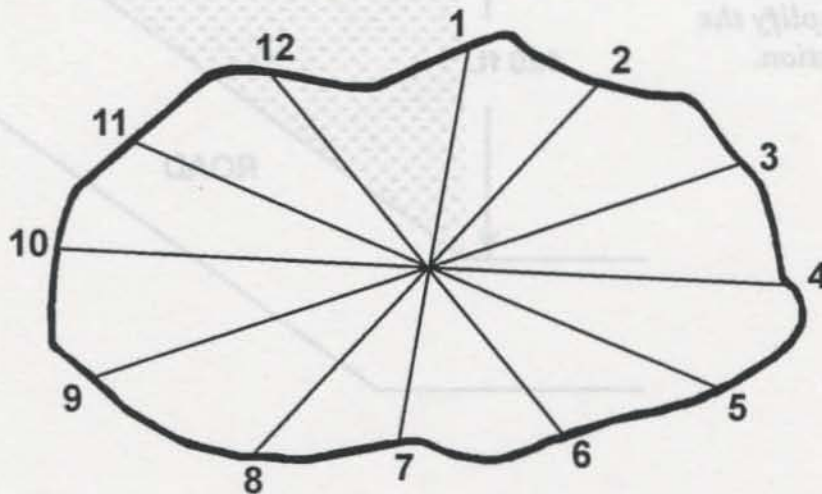


3. A third method is to calculate the area using the formula for a circle. From a center point, measure the distance to 10-20 points along the edge of the field. Add those measurements together and divide by the number of measurements to find the average radius.

Example:

$$\text{Area} = 3.14 \times (\text{average radius})^2$$

$$\text{Average radius} = 1/12 (\text{line 1} + \text{line 2} + \dots + \text{line 12})$$



Prepared for *Pesticide Applicator Training* course by C. Nagamine.  
Department of Environmental Biochemistry, 1800 East-West Rd. #329,  
Honolulu, HI 96822. Adapted from *Ornamental and Turfgrass Pest Control* by  
M. A. Wamsley and D. M. Vermeire, pp. 10-11.

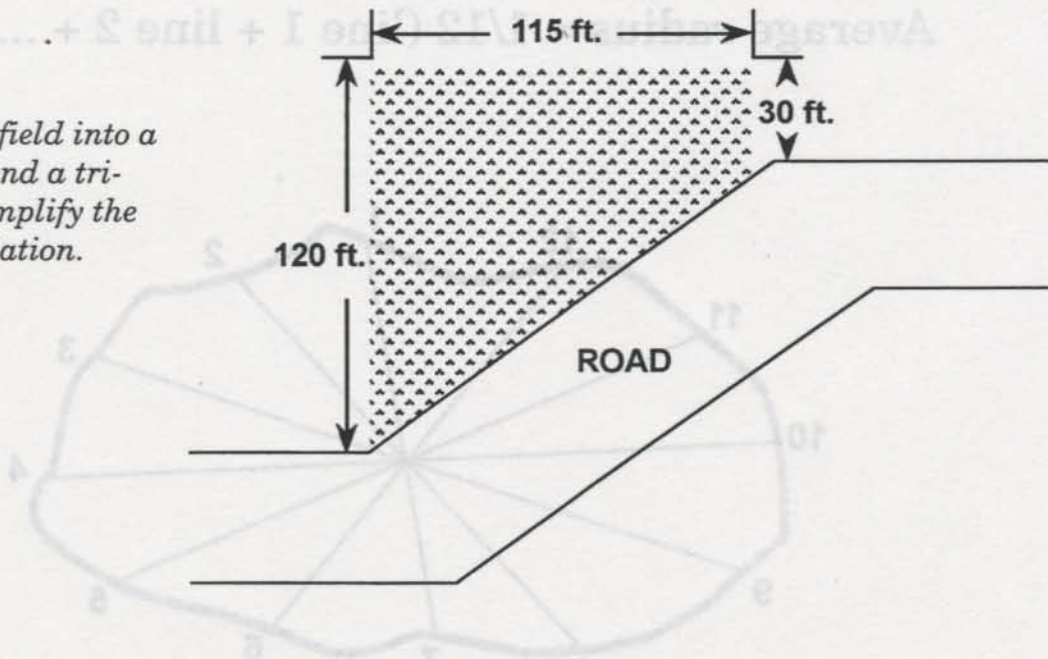
## Dosage Calculation Homework

Your sprayer tank can hold 25 gallons of spray mix. Your field of eggplant is shown in the diagram below. You calibrated your sprayer and found that you use 192 gallons of spray mix per acre for your field of eggplants. The label directions for Carbodan 40W Insecticide say: "EGGPLANTS: Use 3 pounds per acre in sufficient water to thoroughly cover top and bottom leaf surfaces." You want to apply a dosage of 2 1/2 pounds per acre.

1. What is the area of your eggplant field? (Answer in square feet or in acres.) Show your calculations.

### DIAGRAM OF EGGPLANT FIELD

- a. Divide the field into a rectangle and a triangle to simplify the area calculation.



- b. The area of the rectangle = length x width = 115 ft. x 30 ft. = 3,450 sq. ft.
- c. The area of the triangle = 1/2 (base x height) = 1/2 (90 ft. x 115 ft.) = 5,175 sq. ft.
- d. The total area = 3,450 sq. ft. + 5,175 sq. ft. = 8,625 sq. ft.
- e. Convert the answer from sq. ft. to acres:

$$8,625 \text{ sq. ft.} \times \frac{1 \text{ acre}}{43,560 \text{ sq. ft.}} = \frac{8,625 \text{ sq. ft.} \times 1 \text{ acre}}{43,560 \text{ sq. ft.}} = 0.198 \text{ acre}$$

**ANSWER: 0.19800 acre. or 8,625 sq. ft.**

2. How many gallons of spray mix will you need to treat the entire field?  
Show your calculations.

$$\frac{192 \text{ gal.}}{1 \text{ acre}} \times \frac{0.19800 \text{ acre}}{\text{field}} = \frac{38 \text{ gal.}}{\text{field}}$$

**ANSWER:** It takes 38 gallons of spray mix to treat the entire field.

3. How much pesticide should you measure out for 1 full tank load of spray mix?  
Show your calculations.

$$\frac{2.5 \text{ lb.}}{1 \text{ acre}} \times \frac{1 \text{ acre}}{192 \text{ gal.}} \times \frac{25 \text{ gal.}}{\text{tank}} = \frac{0.326 \text{ lb.}}{\text{tank}}$$

$$\frac{0.326 \text{ lb.}}{\text{tank}} \times \frac{16 \text{ oz.}}{1 \text{ lb.}} = \frac{5.2 \text{ oz.}}{\text{tank}}$$

**ANSWER:** It takes 5.2 oz. of pesticide to make a full 25 gal. tank of spray mix.

4. After spraying the field with one full tank load, how many more gallons of spray mix will you need to finish the job? Show your calculation.

$$\begin{array}{r} 38 \text{ gal.} \\ - 25 \text{ gal.} \\ \hline 13 \text{ gal.} \end{array}$$

**ANSWER:** 13 gallons of spray mix are required to finish the job.

5. How much pesticide should you measure out to make another 13 gallons of spray mix? Show your calculations.

$$\frac{2.5 \text{ lb.}}{1 \text{ acre}} \times \frac{1 \text{ acre}}{192 \text{ gal.}} \times \frac{13 \text{ gal.}}{\text{partial tank}} = \frac{0.169 \text{ lb.}}{\text{partial tank}}$$

$$\frac{0.169 \text{ lb.}}{\text{partial tank}} \times \frac{16 \text{ oz.}}{1 \text{ lb.}} = \frac{2.7 \text{ oz.}}{\text{partial tank}}$$

**ANSWER:** 2.7 oz. of pesticide are needed to make 13 gallons of spray mix.



## Material Safety Data Sheet (MSDS)

1. A Material Safety Data Sheet (MSDS) is available for every pesticide.
2. Pesticide manufacturers are required by U.S. federal law to provide a copy if you ask for one. It may be easier to ask a local pesticide seller or distributor for a copy.
3. MSDS information helps you determine what supplies and equipment you need:
  - a. For worker protection.
  - b. For spill clean up.
  - c. For fire control.
4. Review the sample MSDS for Gramoxone.

# GRAMOXONE® EXTRA

## MATERIAL SAFETY DATA SHEET

### MANUFACTURER

ICI AMERICAS INC.

Wilmington, Delaware 19897

Phone (24 hr.) Technical: (302) 886-3000

Medical: (800) 327-8633

Reference No: 3967

Rev: A

Issue Date: 08/16/89

### SECTION 1 - NAME & HAZARD SUMMARY

Material name: GRAMOXONE® EXTRA

Hazard summary (as defined by OSHA Hazard Comm. Std., 29 CFR 1910.1200):

Physical hazards: None

Health hazards: Corrosive (skin), irritant (eye, respiratory passages), inhalation (TLV), toxic (oral)

Read the entire MSDS for a more thorough evaluation of the hazards.

### SECTION 2 - INGREDIENTS

	%	OSHA PEL
***Paraquat dichloride (CAS 1910-42-5)	37.050	0.1 mg/m <sup>3</sup> res. fract.
***Emetic	0.053	Not listed
***Inert	62.897	Not listed

Ingredients not precisely identified are proprietary or nonhazardous. Values are not product specifications.

### SECTION 3 - PHYSICAL DATA

Appearance and odor: Dark liquid with strong, pungent odor

Boiling point: 214 °F, 101 °C

Vapor pressure (mm Hg at 25 degrees Celsius): 24.9

Vapor density (air = 1): No data

Solubility in water: Soluble

pH: 5 (5% solution)

Specific gravity: 1.12

% Volatile by volume: 6.10

### SECTION 4 - FIRE AND EXPLOSION HAZARD DATA

Flash point: Does not flash

Autoignition temperature: No data

Flammable limits (STP): Not applicable

Extinguishing media: Not applicable. Use media suitable for surrounding fire. Minimize use of water to avoid environmental contamination.

Special fire fighting protective equipment: Self-contained breathing apparatus with full facepiece and protective clothing if involved in a fire of other materials.

Unusual fire and explosion hazards: Possible toxic smoke, vapors, fallout and runoff water can result from fires depending on extent of combustion and presence of other combustible materials. Contaminated buildings, areas, and equipment must be properly decontaminated before reuse.

### SECTION 5 - REACTIVITY DATA

Stability: Stable under normal conditions. Decomposes at 300 °C.

Incompatibility: Corrosive to mild steel, galvanized iron and aluminum. Hydrolyzes in alkaline media.

Hazardous decomposition products: Combustion products of dry material: Carbon dioxide, carbon monoxide. Nitrogen oxides, ammonia. Halogen, halogen acids, possible trace amounts of carbonyl halide.

Hazardous polymerization: Will not occur.

## SECTION 6 - HEALTH HAZARD ASSESSMENT

**General:** The health hazard assessment is based on the results of animal toxicity testing and reports of accidental human exposures.

**Ingestion:** The acute oral LD<sub>50</sub> in rat is 40-150 mg (of cation)/kg; in man it is 30-40 mg/kg.

\*\*\*Grave poisonings and deaths have been reported after accidental or suicidal ingestions. An emetic is included in the formulation to induce vomiting. Signs and symptoms following ingestion include burning sensations, ulcerations of the mouth, tongue, pharynx and esophagus; vomiting, retching, and diarrhea may then ensue. A 2 to 3 week period of progressive kidney failure, liver complications, and pulmonary insufficiency may follow. Death is usually due to respiratory failure secondary to pulmonary fibrosis.

**Eye contact:** Sever acute inflammatory changes may be the result of eye contact, reaching maximum effect in 12 to 24 hours. Surfactants tend to potentiate effects that develop after eye contact; the effects represent chemical burns. Although the eye injury may appear to be extensive, a slow but complete recovery usually occurs.

**Skin contact:** Repeated and/or prolonged skin contact with the concentrated product can cause skin damage, including erythema, edema, and ulceration. Repeated and/or prolonged skin contact with the spray dilution may cause mild skin irritation. Contact with finger and toe nails may result in cracking and shedding; normal regrowth follows.

**Skin absorption:** Paraquat penetrates intact skin very slowly. Penetration is faster through injured or damaged skin. Prolonged contact with the concentrate can damage skin and thus poisoning can occur more readily. Lung, kidney and liver injuries can ensue, followed by renal and pulmonary insufficiency. Death ensues after respiratory failure.

The dermal LD<sub>50</sub> in rabbit following a 24-hour exposure period is 240 mg of cation/kg. Relative to other materials, a single application of this product is moderately toxic by skin absorption.

**Inhalation:** Paraquat is not volatile; therefore, exposure to paraquat vapor is not likely to occur. Prolonged inhalation or overexposure to a spray mist or diluted paraquat can cause irritation of the upper respiratory tract mucosa, as evidenced by a burning sensation, nose bleeds, and sore throat. These symptoms remit on cessation of exposure. Systemic toxicity is unlikely to develop following inhalation because spray aerosols are not likely to be of respirable size.

**Effects of overexposure:** The greatest hazards of paraquat exposure exist when the concentrated product is swallowed or allowed to remain in contact with the skin for a prolonged period. These circumstances can result in systemic poisoning which is severe, progressive, and frequently terminates in irreversible lung damage and death. The concentrated product can cause adverse local effects on eyes, skin, and nails. These problems are not normally seen with spray dilutions. Excessive exposure to spray mist can cause upper respiratory tract irritation.

### First aid procedures:

**DO NOT** attempt a rescue without adequate skin and respiratory protection. Immediate treatment is essential.

**Skin:** Remove contaminated clothing and footwear. Wash skin thoroughly with plenty of soap and water. Get medical attention.

**Eyes:** Immediately flush with plenty of water for at least 15 minutes and have eyes examined and treated by an eye specialist.

**Ingestion:** Give one or more glasses of water to drink and induce vomiting by sticking finger down throat. Repeat until vomit is clear. Get immediate medical attention. If bentonite, activated charcoal or fullers earth is available, administer it.

**Inhalation:** Move victim to uncontaminated area and get immediate medical attention.

**Note to Physician:** There is no effective antidote for oral paraquat poisoning. Prompt treatment is *essential* following ingestion. Paraquat is inactivated by its tight bonding to clay. Absorption can be reduced by administering adsorbents such as *bentonite*, *activated charcoal* or *fullers earth*. A cathartic should also be given. In selected cases of paraquat poisoning the modalities of hemoperfusion and hemodialysis may be considered. For further questions on medical treatment, call the ICI Medical Emergency Information Center at (800) 327-8633; dial 800 F-A-S-T-M-E-D

## SECTION 7 - SPILL OR LEAK PROCEDURES

**Steps to be taken in case material is released or spilled:** Wear eye protection, protective clothing and respiratory protection during cleanup. Mix with a generous amount of clay or clay-containing soil and shovel into waste container. Untreated spilled material can dry to a highly irritating dust.

**Disposal method:** Do not contaminate waterways, streams or ponds when cleaning equipment or disposing of waste. Although GRAMOXONE is not a RCRA hazardous waste, it is recommended that the waste be disposed of in a facility permitted for hazardous waste.

**Container disposal:** Empty container retains product residue. Observe all hazard precautions. Do not distribute, make available, furnish, or reuse empty container except for storage and shipment of original product. Triple rinse empty container, return rinse water to dilution mixture, and dispose of dilution mixture as a hazardous waste. Puncture or otherwise destroy rinsed container and dispose of in a facility permitted for nonhazardous waste.

## SECTION 8 - SPECIAL PROTECTION INFORMATION

\*\*\*TLV<sup>®</sup> or suggested control value: Paraquat dichloride: The OSHA PEL and ACGIH TLV is 0.1 mg/m<sup>3</sup> respirable fraction as an 8-hour time weighted average with a skin notation. ICIA operates its facilities so that exposures to total paraquat dust/aerosol do not exceed 0.1 mg/m<sup>3</sup> 8-hour TWA. The OSHA PEL for paraquat is 0.5 mg/m<sup>3</sup> total dust with a skin notation. Emetic: ICIA operates its facilities so that exposure to the emetic do not exceed 0.1 mg/m<sup>3</sup>.

**Ventilation:** This product is intended for use outdoors where engineering controls are not necessary. If use conditions are different (e.g. product reformulation or repackaging), use ventilation adequate to maintain safe levels.

## Application Methods and Equipment

**Respiratory protection (specify type):** If needed, use MSHA-NIOSH approved respirator for pesticides.

**Protective clothing:** Prevent skin contact. Use impervious gloves, apron and boots. Depending upon conditions of use, additional protection may be required such as arm covers or full body suit. Remove any contaminated clothing promptly. ICIA conducted ASTM permeation tests using *PVC gloves* (0.2 mm thickness). No breakthrough of product was detected after eight hours of testing.

**Eye protection:** Chemical tight goggles with full faceshield.

**Other protective equipment:** Eyewash station and safety shower near work area.

### SECTION 9 - SPECIAL PRECAUTIONS OR OTHER COMMENTS

Precautions to be taken in handling or storing: Store above 32 °F in original well-marked containers away from feed or food. Material is toxic to wildlife. Keep out of lakes, streams and ponds. Follow good hygiene practice to avoid skin and eye contact, breathing vapors, or accidental ingestion. Hands and face should be thoroughly washed with soap and water prior to eating, drinking or smoking. Eating, drinking or smoking should not be allowed in areas where this substance is handled. Work clothes should be laundered regularly. All protective equipment should be kept clean and stored properly. Do not enter treated areas without protective clothing until sprays have dried. Avoid working in spray mist. If there is risk of exposure, wear goggles and NIOSH approved pesticide respirator. Paraquat binds readily to clay and soil which contains clay to become biologically inactive. In this bound form, leaching of paraquat does not occur. For emergency information on spills, leaks and fires involving Gramoxone (Paraquat) Herbicide, call (800) 424-9300 Chemical Transportation Emergency Center (CHEMTREC).

### SECTION 10 - REGULATORY INFORMATION

**TSCA (Toxic Substances Control Act) Regulations, 40 CFR 710:** All ingredients are on the TSCA Section 8(b) Inventory.

**CERCLA and SARA Regulations (40 CFR 355, 370, and 372):** This product does not contain any chemicals subject to the reporting requirements of SARA Section 313.

The information herein is given in good faith but no warranty, expressed or implied, is made.

Prepared/Reviewed: 05/25/89

CCDB: C13726

\*\*\*This line or section contains revisions or new statements since the last issue date.

Example #2: Reporting a pesticide release.

You are driving on a public road with a bottle of *Paraquat* in the back of the truck. When you drive through a large pot hole, the bottle falls onto the road, breaks open, and completely spills its contents.

a. Are you required by law to report this accident?

**It depends on how much chemical was spilled.**

b. Name the law.

**SARA Section 304, "Emergency release Notification."**

c. To what agency (or agencies) should you report this kind of accident?

**i. Emergency Planning Committee.**

**ii. National Response Center.**

## Pesticides and SARA

1. Reportable Quantity (RQ)
  - a. Reportable Quantities are addressed in Section 304, "Emergency Release Notification," of SARA.
  - b. If in a spill, leak or fire, you release more than the RQ of any chemical listed (see RQ column of table), you are required to give initial and follow-up emergency notifications to the appropriate agencies.
  
2. Initial emergency notification
  - a. Agencies to contact
    - i. Emergency Planning Committee
    - ii. National Response Center, 1-800-424-8802.
    - iii. If the release occurs in a transportation accident, dial 911 or contact the telephone operator to fulfill the initial emergency notification requirement.

- b. Provide the following information:
  - i. Name and telephone number of person(s) to contact for more information.
  - ii. Location of release.
  - iii. Chemical name of substance(s) involved.
  - iv. Indication if substance is on list (see RQ column in the table).
  - v. Amount released. Estimate if necessary.
  - vi. Time and duration of release.
  - vii. Whether release occurred into air, water, or soil.
  - viii. Known or anticipated acute or chronic health risks associated with the release. When appropriate, advise if medical attention is needed for people exposed to the chemical.
  - ix. Necessary precautions such as evacuation or traffic control, unless such information is already available to the emergency coordinator.
3. Follow-up emergency notification
  - a. Agencies to contact
    - i. Local Emergency Planning Committee.
    - ii. Emergency Response Commission.

- b. Information to give
    - i. The same items as for initial emergency notification but updated.
    - ii. Actions taken to respond to and contain the release.
4. Threshold Planning Quantities (TPQ)
- a. TPQ's are addressed in Sections 311 and 312, "Hazardous Chemical Reporting," of SARA.
  - b. If you store more than the TPQ of any chemical listed (see TPQ column in table) you must notify these agencies:
    - i. Emergency Response Commission.
    - ii. Emergency Planning Committee.
    - iii. Fire department.
  - c. Provide the following information:
    - i. Copies of Material Safety Data Sheets (MSDS) for each hazardous chemical or a list of all MSDS's.
    - ii. Annual inventory.



## PARTIAL LIST OF THRESHOLD PLANNING QUANTITIES (TPQ) AND REPORTABLE QUANTITIES (RQ)

The following is a partial list of the TPQ and RQ for some common pesticides and other chemicals. It is compiled from The Final Rules published in the Federal Register, April 22, 1987, and from SARA Title III, Consolidated Chemical List, April 20, 1988. Many "hazardous chemicals" which are not pesticides are left out.

Under federal and state laws, "hazardous chemicals" are those chemicals for which there is a Material Safety Data Sheet (MSDS). According to SARA, some of the "hazardous chemicals" are very toxic and are designated "Extremely Hazardous Substances."

Chemical Name (common and/or brand name)	TPQ (lbs.)* active ingredient	RQ (lbs.) <sup>1</sup> active ingredient
Aldicarb (Temik)	100/10,000	1
Aldrin	500/10,000	1
Aluminum phosphide (Phostoxin, Fumitoxin)	500	100
Amitrole		1
Ammonia	500	100
Azinphos-methyl (Guthion)	10/10,000	1
Azinphos-ethyl (Gusathion)	100/10,000	(1)
Bromadiolone (Maki)	100/10,000	(1)
Cacodylic acid		1
Calcium hypochlorite		10
Captan		10
Carbaryl (Sevin)		100
Carbofuran (Furadan)	10/10,000	10
Chlordane (C-100, Termide)	1000	1
Chlorine	100	10
Chlormequat chloride (Cycocel)	100/10,000	(1)
Chloroform	10,000	5000
Chlorophacinone (Rozol)	100/10,000	(1)
Chloroxuron (Tenoran)	500/10,000	(1)
Chlorpyrifos (Dursban)		1
Creosote		1
2,4,-D Acid		100
2,4,-D Ester		100
DDT		1
Demeton (Systox)	500	(1)
Demeton-S-methyl (Metasystox)	500	(1)
Diazinon		1
Dicamba (Banvel)		1000
Dichlobenil		100
1,3-Dichloropropene		100
Dichlorvos (Vapona, DDVP)	1000	10
Dicofol (Kelthane)		10
Dicrotophos	100	(1)
Dieldrin		1
Dimethoate (Cygon)	500/10,000	10
Dinoseb	100/10,000	1000

Chemical Name (common and/or brand name)	TPQ (lbs.)* active ingredient	RQ (lbs.) <sup>1</sup> active ingredient
Dioxathion (Deltic)	500	(1)
Diquat		1000
Disulfoton (Di-syston)	500	1
Diuron (Karmex)		100
EPN	100/10,000	(1)
Endosulfan (Thiodan)	10/10,000	1
Endrin	500/10,000	1
Fenamiphos (Nemacur)	10/10,000	(1)
Fensulfothion (Dasanit)	500	(1)
Fonofos (Dyfonate)	500	(1)
Formaldehyde (Formalin)	500	1000
Heptachlor		1
Lindane ("gamma-BHC")	1,000/10,000	1
Malathion		100
Methamidophos (Monitor)	100/10,000	(1)
Methiocarb (Mesurol)	500/10,000	10
Methomyl (Lannate, Nudrin)	500/10,000	100
Methoxychlor (Marlate)		1
Methyl bromide (Dowfume, Bromo-gas)	1,000	1000
Mevinphos (Phosdrin)	500	10
Mexacarbate (Zectran)	500/10,000	1000
Monocrotophos (Azodrin)	10/10,000	(1)
Naled (Dibrom)		10
Oxamyl (Vydate)	100/10,000	(1)
Oxydisulfoton (Disyston-S)	500	(1)
Paraquat (Gramoxone)	10/10,000	(1)
Parathion	100	1
Parathion-methyl	100/10,000	100
Phorate (Thimet)	10	10
Phosgene	10	10
Phosmet	10/10,000	(1)
Phosphamidon	100	(1)
Phosphine	500	100
Pyrethrins		1
Sodium cacodylate	100/10,000	(1)
Terbufos (Counter)	100	(1)
Toxaphene	500/10,000	1
Warfarin	500/10,000	100
Zinc phosphide	500	100

\* The lower quantity applies only if the solid exists in powdered form and has a particle size less than 100 microns, is handled in solution or in molten form, or meets the criteria for a National Fire Protection Association (NFPA) rating of 2, 3, or 4 for reactivity.

<sup>1</sup> RQ's in parenthesis are listed in the Federal Register, April 22, 1987, but are not listed in the SARA Title III, Consolidated Chemical List, April 20, 1988.

This handout was prepared for the Pesticide Applicator Training course sponsored by the Cooperative Extension Service, College of Tropical Agriculture & Human Resources, University of Hawaii. Direct comments to: Charles Nagamine; Dept. of Environmental Biochemistry; 1800 East-West Rd., #329; Honolulu, HI 96822. Phone (808) 956-2005.

## Fires Involving Pesticides

### Prevention

1. A safe fireproof storage area.
2. Remove all flammable trash (paper, cardboard, wood, leaves, dried grass) from in and around the storage area.
3. Make a fire plan
  - a. MSDS and inventory
    - i. Keep extra copies elsewhere.
    - ii. Update records.
  - b. Road entrances for fire fighters
    - i. Who has the keys to locked gates?
    - ii. Alternate entry if fire or smoke blocks main entry.
    - iii. Names and phone numbers of warehouse manager, supervisor, etc.
  - c. Threshold Planning Quantity (TPQ) reporting requirements for large amounts of pesticides.

## Rubbish Fires

1. Keep a fire extinguisher available.
2. Use dirt or sand to smother fire.
3. Water
  - a. Use as little as possible.
  - b. Keep pesticides dry.
  - c. Water spreads chemicals around and makes it difficult to clean up liquid “hazardous waste”.

## Chemical Fires

1. Stay out of smoke.
2. Warn people downwind.
3. Don't fight the fire on your own; you need special training and equipment.
4. Call 911, the police, or the fire department.
5. Prepare MSDS, inventory, and TPQ list for fire fighters.



## Checklist for Section Four

### SLIDES

\_\_\_\_\_ Drift Mechanics

### AV EQUIPMENT

- \_\_\_\_\_ Slide projector
- \_\_\_\_\_ Adaptor plugs for 3-prong cords
- \_\_\_\_\_ Overhead projector
- \_\_\_\_\_ Extension cords
- \_\_\_\_\_ Slide projector remote extension cord

## Introduction

- SLIDES** "Protecting the Environment from Pesticides" (~ 15 min.)
- CIRCULATE** Sign-up/attendance sheet.

## Pesticides in the Environment

- DEFINE** The term "environment". See p. 142.
- EXPLAIN** How pesticides enter and move in the environment.  
See pp. 143-144.
- EXPLAIN** "Particle Drift." See pp. 145-148.  
Use slides, "Drift Mechanics".
- EXPLAIN** Problems Resulting from Pesticides in the Environment.  
See p. 154-156.

## **Hazards to Pesticide Applicators**

- EXPLAIN** "Hazard vs. toxicity." Use U. C. slide set, "Toxicology Science of Poisons". A very toxic pesticide can be used in a manner that presents a little hazard but a low toxicity chemical can be used in a manner that is very hazardous. It depends on how much you are exposed to the pesticide.
- EXPLAIN** Hazards to Pesticide Applicators. See pp. 158-164.
- DISCUSS** Worker Protection Standards (WPS). See pp. 165-172.

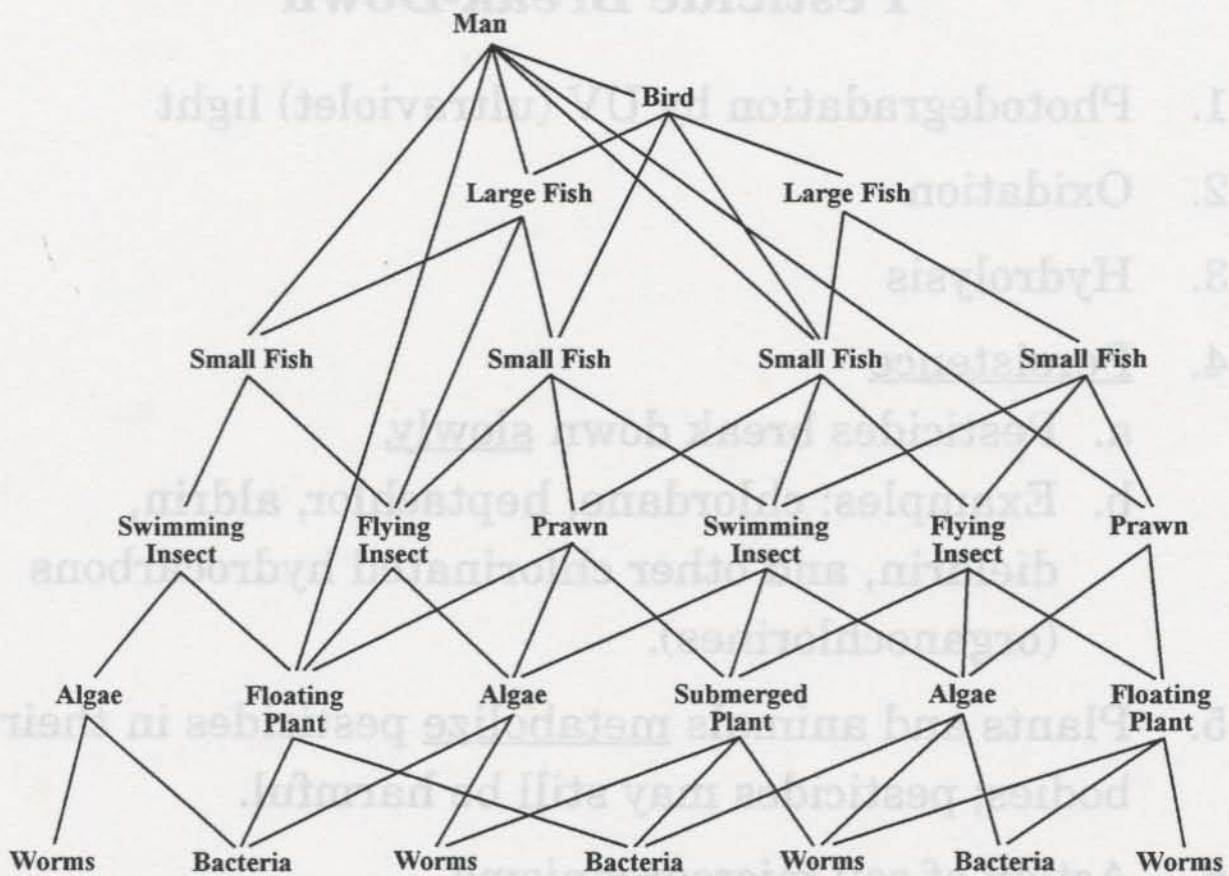
**SECTION 4:  
PESTICIDES AND THE ENVIRONMENT**

**Pesticides and the Environment  
Mechanics of Drift  
Water Contamination  
Problems from Pesticides in the Environment  
Hazards to Pesticide Applicators**



## The Environment

1. Air, soil, water, plants, people, target, and non-target organisms.
2. Target organisms are the organisms that need to be controlled.
3. Non-target organisms are those you don't intend to control. Examples are beneficial insects, plants, fish, wildlife, birds, pets, and people.
4. Food web interactions.



Food Web of a Pond Ecosystem

## How Pesticides Enter the Environment

1. Applying a pesticide = putting a pesticide into the environment for a specific purpose.
  - a. We gain benefits, but...
  - b. Try to minimize amount of pesticides in the environment.
2. Improper disposal.
3. Accidental spills.

## Pesticide Break-Down

1. Photodegradation by UV (ultraviolet) light
2. Oxidation
3. Hydrolysis
4. Persistence
  - a. Pesticides break down slowly.
  - b. Examples: chlordane, heptachlor, aldrin, dieldrin, and other chlorinated hydrocarbons (organochlorines).
5. Plants and animals metabolize pesticides in their bodies; pesticides may still be harmful.
6. Action of soil microorganisms.
7. Pesticides break down at different rates.

## Pesticide Movement Through the Environment

1. Particle drift
2. Non-drift movement by wind
  - a. Evaporation of chemicals from treated surface.
  - b. Ester formulations of phenoxy herbicides vaporize more easily than amine formulations.
  - c. Pesticide dust and crystals left on target.
  - d. Wind scatters soil containing pesticides.
3. Leaching: Downward movement of water and chemicals through the soil into groundwater.
4. Run-off: Water moves soil particles containing chemicals.
5. Residues on treated objects
  - a. Food plants and by-products.
  - b. Feed and forage plants.
  - c. Animal products: Meat, milk, eggs.
  - d. Household utensils and work surfaces.
  - e. Ornamental plants. Temik® label warning: "Do not market potted plants within 4 weeks after last application."
  - f. Pesticide application equipment.

## Droplet Size and Drift

1. Droplet diameter measured in microns.  
One micron = .000001 meter.
2. Droplets smaller than 100 microns are barely visible and cause most drift problems. There may be a significant amount of drift we cannot see.
3. Spray droplets shrink after they leave the nozzle. (Oil-based spray droplets do not.) As droplets shrink, they become more concentrated and fall through the air more slowly; this makes the droplets travel farther in the wind.
4. Updrafts from the warm ground prevent small droplets from reaching the target. Droplets may actually be carried upward.
5. "Vapor drift": Evaporated active ingredients (ester forms of 2, 4-D) can cause problems down wind.
6. Droplet size spectrum: Conventional spray nozzles produce droplets of many different sizes.
7. Applicator's dilemma: Need large droplets to prevent drift but small droplets give better coverage.

## Factors that Affect Drift

1. Droplet size spectrum
  - a. Type of nozzle: Flooding fan nozzles produce many large droplets and few small droplets.
  - b. Size of nozzle tip orifice: Large opening produces more large droplets and fewer small ones.
  - c. Spraying pressure: Lower pressure produces more large droplets and fewer small droplets.
  - d. Drift retardants added to spray mixture
    - i. Work best when used at pressures less than or equal to 40 psi with large nozzle orifice.
    - ii. Do not play a big role in reducing drift.
2. Wind speed and direction
  - a. Strong wind increases chance of drift.
  - b. Use flags, and wind vanes to study conditions.
  - c. Note time of day when wind speed increases.
  - d. Air movements when sunlight heats the earth
    - i. Trade winds
    - ii. On-shore breeze after ground heats up.
    - iii. Off-shore breeze after ground cools.
  - e. Time of day
    - i. Early morning and late afternoon conditions: cool air near ground, warm air higher up.
    - ii. Small droplets remain near the ground.

## Example of Tradewind Patterns

### Northeast Tradewinds



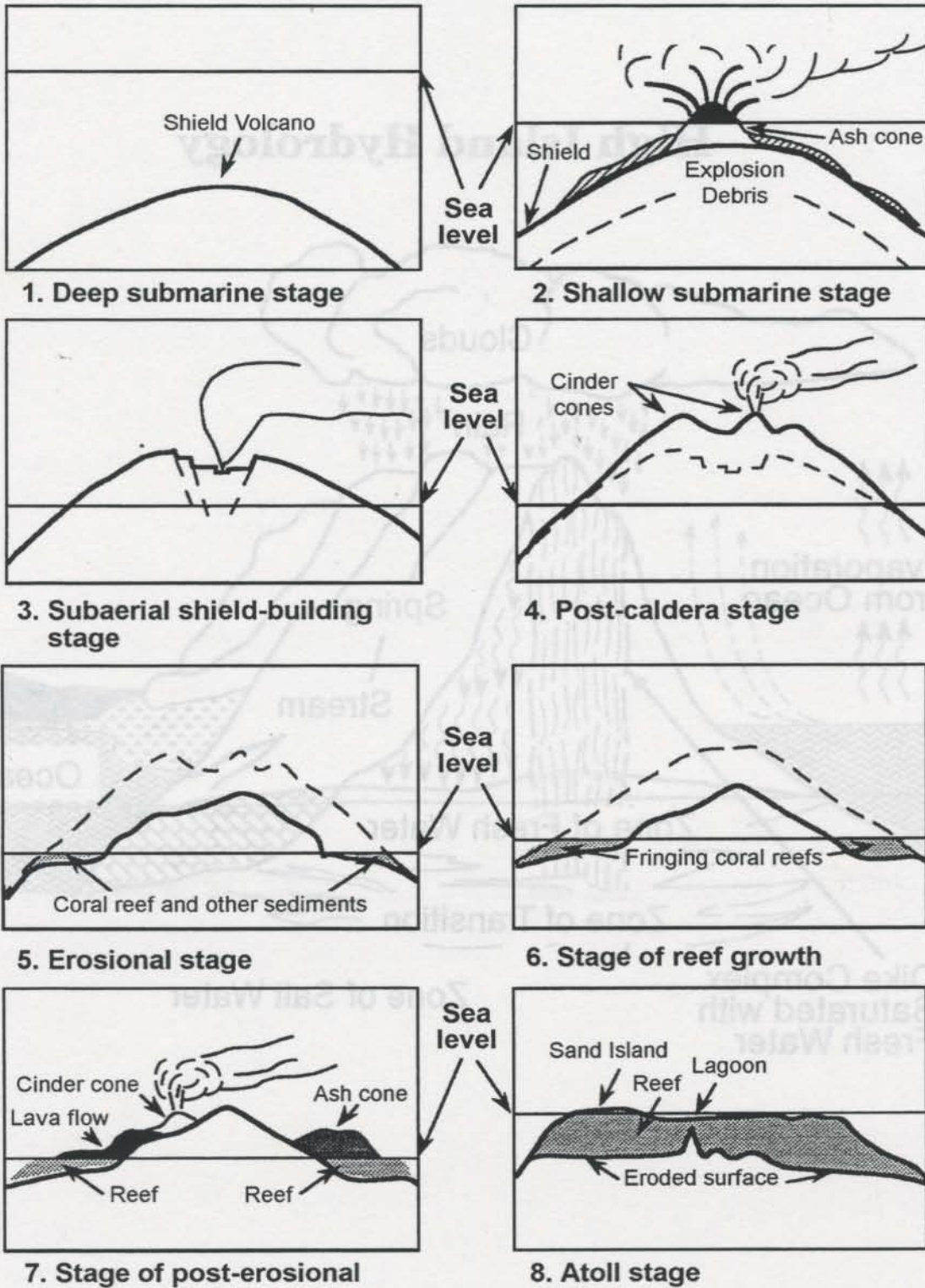
- f. Changes in wind direction
  - i. Valleys
  - ii. Buildings
  - iii. Windbreaks allow some air through. For each foot of height, a windbreak reduces wind speed 7 to 10 feet downwind.
3. Distance from nozzle to target: The closer the target, the lower the chance of drift.
4. Equipment and formulation of pesticide
  - a. Mist blowers, foggers, and dusters produce small droplets with little or no control over drift.
  - b. Liquid sprayers have moderate drift problems.
  - c. Granular pesticides and wipe-on (wick) applicators have little or no drift.
5. Air temperature and humidity affect droplet evaporation (shrinking).
6. Nozzle orientation: Important for aerial spraying. Point nozzles downward or backward.
7. Buffer zone
  - a. Area between target area and neighboring sensitive areas.
  - b. Do not spray in buffer zone. Not a legal requirement but it is good for public relations.

## Pesticides in Groundwater

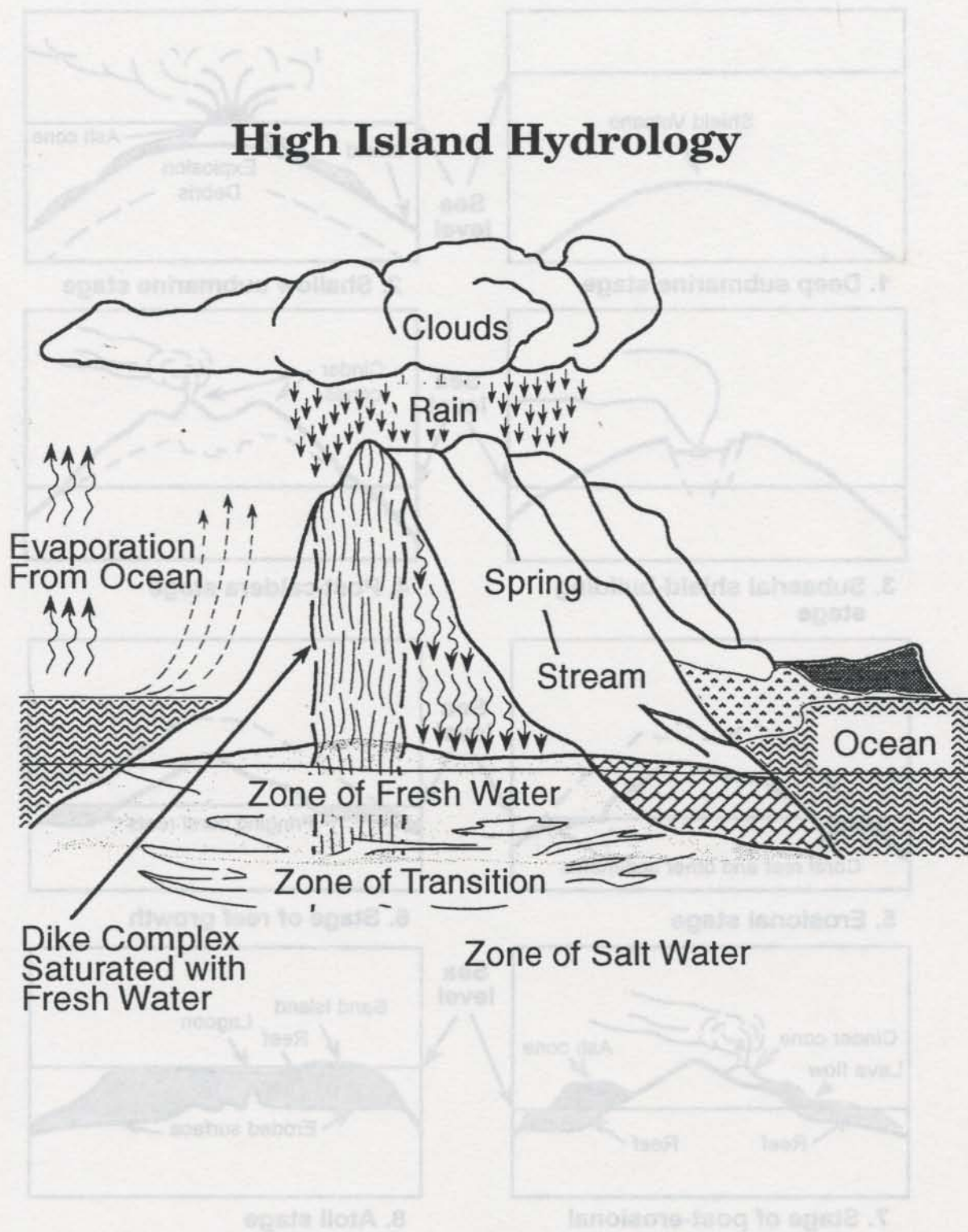
1. Geology of the Pacific Islands
  - a. Islands made of layers of porous lava rock.
  - b. Dikes
  - c. Perched water in some places.
  - d. Water lens
    - i. Mostly fresh water.
    - ii. Forms when rainwater percolates through soil (recharge) and forces sea water out pores in lava rock.
    - iii. Caprock keeps fresh water from flowing out to sea.
2. Farm practices that cause groundwater contamination
  - a. Handling concentrates carelessly.
  - b. Using leaking containers.
  - c. Improper disposal of chemicals
    - i. Excessive spray mix concentration.
    - ii. Rinse water run-off.
    - ii. Residue in “empty” containers.
  - d. Chemigation.
  - e. Bad irrigation timing (before heavy rain).
  - f. Excess irrigation.



# Life Stages of Volcanic Islands



# Life Stages of Volcanic Islands



Adapted from *Atlas of Hawaii*, University of Hawaii Press, 1983.

## Factors That Increase the Risk of Water Contamination

1. Properties of the chemical (look for label warnings)
  - a. High solubility.
  - b. Poor binding to soil.
  - c. Persistence: Resistance to breakdown.
  
2. Properties of the soil
  - a. Porous soil.
  - b. Low level of organic matter.
  
3. Conditions at the site
  - a. Shallow depth from surface to groundwater.
  - b. Wet climate.
  - c. Extensive irrigation.
  
4. Pesticide management
  - a. Injection or soil incorporation.
  - b. Poor timing: Heavy rain or irrigation immediately after application.

**RESTRICTED USE PESTICIDE  
(GROUND WATER CONCERN)**

FOR RETAIL SALE TO AND USE ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION AND ONLY FOR THOSE USES COVERED BY THE CERTIFIED APPLICATORS CERTIFICATION.

THIS PRODUCT IS A RESTRICTED-USE HERBICIDE DUE TO GROUND WATER CONCERNS. USERS MUST READ AND FOLLOW ALL PRECAUTIONARY STATEMENTS AND INSTRUCTIONS FOR USE IN ORDER TO MINIMIZE POTENTIAL FOR ATRAZINE TO REACH GROUND WATER.

# AAtrex<sup>®</sup> 4L

## Herbicide

For season-long weed control in corn and sorghum. For seed control in certain other crops, in noncrop areas, and industrial sites.

### Active Ingredients

Atrazine: 2-chloro-4-ethylamino-6-isopropylamino-  
s-triazine ..... 40.8%  
Related compounds ..... 2.2%

Inert Ingredients ..... 57.0%

---

Total ..... 100.0%

## Problems Resulting from Pesticides in the Environment

1. Direct kill of non-target organisms in target area
  - a. Bees and other beneficial insects.
  - b. Birds.
  - c. Fish.
  - d. Look for warnings on label.
2. Secondary poisoning: Consuming poisoned organisms
  - a. Birds.
  - b. Predators of poisoned rodents.
3. Bioconcentration in the food chain
  - a. Accumulation of persistent pesticides.
  - b. Highest concentration in organisms at the top of food chain (often in human beings).
4. Pests develop resistance to pesticide.
5. Carry-over
  - a. Accumulation and persistence of pesticide in soil from one crop to the next.
  - b. Phytotoxicity symptoms in next crop.
  - c. Illegal residues of persistent pesticides.

6. Phytotoxicity: Chemical damage to plants
  - a. Lethal vs non-lethal dosage
  - b. Wide variety of symptoms
    - i. Malformed leaves
    - ii. Discolored leaves
    - iii. Leaf and fruit drop
    - iv. Stunted growth
  - c. Causes
    - i. Plants cannot tolerate solvent or active ingredient.
    - ii. Plants are too young.
    - iii. Plants are weakened by insect damage, disease, lack of water/nutrients.
    - iv. Temperature and/or humidity too high at time of application.
    - v. Pesticide mixture incompatible.
    - vi. Spray mixture too concentrated.
    - vii. Adjuvants may cause problems.
  - d. Do not confuse phytotoxicity with insect damage, disease, or adverse effects of weather.

7. Animal toxicity
  - a. Animals cannot tolerate active ingredient.
  - b. Animals too young.
  - c. Host reaction to dead internal parasite.
  - d. Spray mixture too concentrated.
  - e. Animals weakened by castration, disease, travel.
  - f. Double dose of cholinesterase inhibitors.
8. Backflow
  - a. Back-siphoning contaminates main water line.
  - b. When filling sprayer tank:
    - i. Prevent siphoning spray mixture from tank into water supply line through water hose.
    - ii. Don't put end of water supply hose below level of spray mixture in tank.
  - c. When applying pesticides in irrigation water (chemigation):
    - i. Prevent backflow of pesticide mixture into water supply line.
    - ii. Install anti-siphon valves in water lines.
  - d. Must have air gap or reduced-pressure principle backflow prevention device.
9. Flooding: High water levels cause run-off from stream or ditch banks that have been treated with a pesticide.

## Warning About Carryover

From NEMACUR label:

**RESTRICTIONS:** Any food crop not specified on this label may be planted into treated areas 120 days after the last application. Any cover crops that are planted during the 120 day period must be plowed under and not grazed.

## Water and Wildlife Warning

From OXAMYL 10% GRANULAR label:

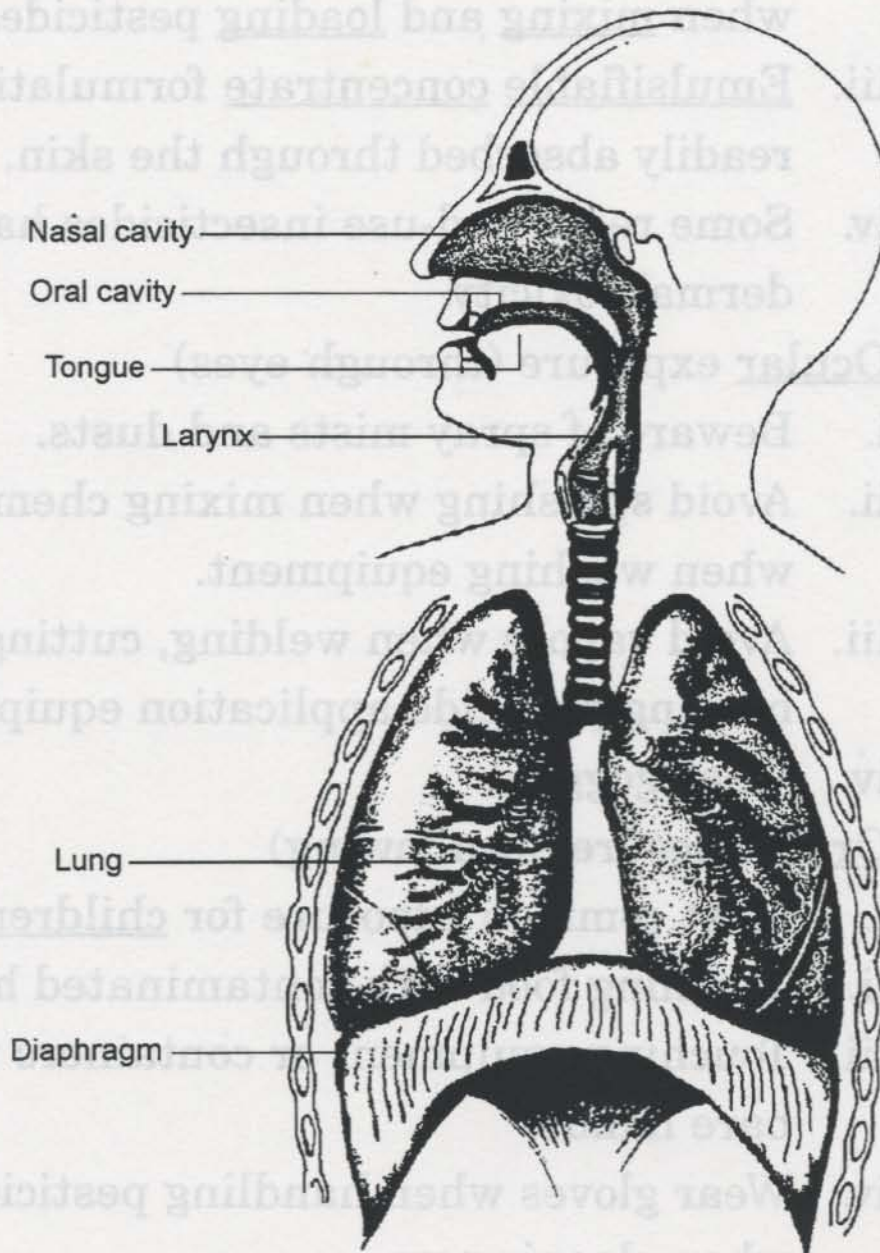
**ENVIRONMENTAL HAZARDS:** This product is hazardous to birds and to other wildlife. Do not apply directly to water. Birds and other wildlife feeding on treated areas may be killed. Cover or incorporate granules which are spilled during loading. Incorporate granules visible on the soil surface in turn areas. Do not contaminate water when cleaning equipment or disposing of wastes or containers.



## Hazards to Pesticide Applicators

1. Four types of pesticides exposure
  - a. Dermal exposure (through skin)
    - i. Most common exposure for pesticide applicators.
    - ii. Occurs commonly and is most hazardous when mixing and loading pesticides.
    - iii. Emulsifiable concentrate formulations are readily absorbed through the skin.
    - iv. Some restricted-use insecticides have high dermal toxicity.
  - b. Ocular exposure (through eyes)
    - i. Beware of spray mists and dusts.
    - ii. Avoid splashing when mixing chemicals or when washing equipment.
    - iii. Avoid vapors when welding, cutting, or brazing pesticide application equipment.
    - iv. Wear goggles.
  - c. Oral exposure (swallowing)
    - i. Most common exposure for children.
    - ii. Touching food with contaminated hands.
    - iii. Touching equipment or containers with bare hands.
    - iv. Wear gloves when handling pesticides or when cleaning up.

- d. Inhalation exposure (through lungs)
- i. Do not smoke when handling pesticides.
  - ii. Wear a respirator.
  - iii. Be careful when welding, brazing, or cutting pesticide application equipment.



2. Factors that affect exposure hazard
  - a. Frequency and dose
    - i. Acute poisoning from single large dose; symptoms appear within hours.
    - ii. Chronic poisoning from repeated small doses; symptoms are delayed for years.
    - iii. Subacute poisoning from several moderate doses; symptoms may be delayed and then appear suddenly. Example: Phosdren® and other insecticides containing Mevinphos, an organophosphate.
  - b. Formulation of pesticide: Greatest hazard of dermal exposure from liquids which contain petroleum solvents.
  - c. Concentration of active ingredient.
  - d. Length of time exposed.
  - e. Part of body exposed.
  - f. Hypersensitivity: Some people are extra sensitive to certain chemicals.

3. Pesticides that may cause acute poisoning
  - a. Organophosphate and carbamate insecticides and nematicides.
  - b. Organochlorine insecticides
    - i. a.k.a. chlorinated hydrocarbon insecticides.
    - ii. Examples: Endrin, aldrin, dieldrin, chlordane, heptachlor, lindane, DDT, kepone, Kelthane® (dicofol), methoxychlor.
  - c. Fumigants: Vikane®, methyl bromide, solvents.
4. Pesticides that may cause skin reactions (rash)
  - a. EBDC's
    - i. Fungicides: Maneb, Zineb, Mancozeb
    - ii. Dithane® and Manzate® fungicides
  - b. Other fungicides
    - i. Captafol (Difolatan®)
    - ii. Chlorothalonil (Bravo®)
  - c. Watch for precautions on labels.
5. Precautions when using pesticides
  - a. Know signs and symptoms of poisoning before handling pesticides.
  - b. Watch for signs and symptoms while using pesticide.

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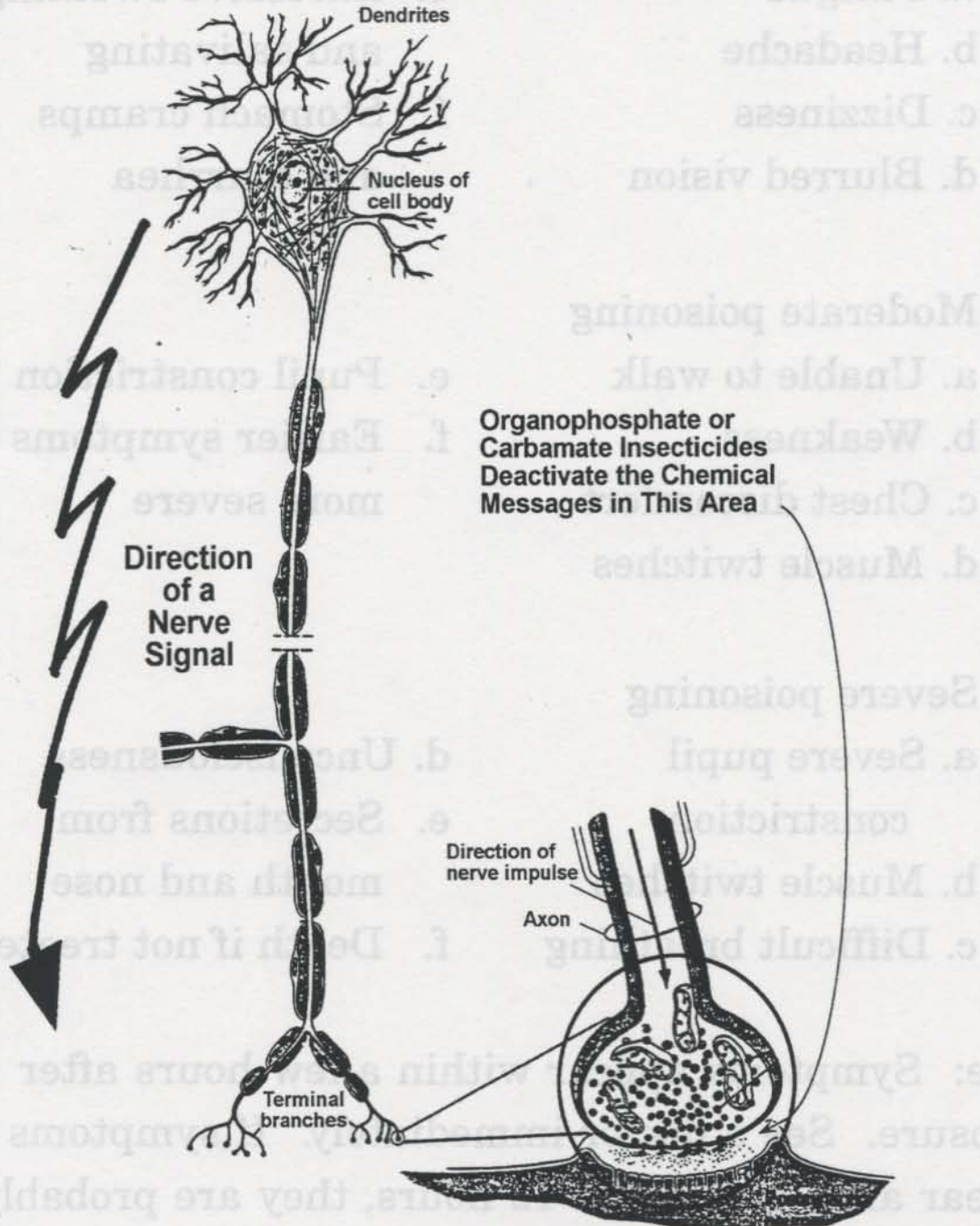
## **Symptoms of Poisoning by Organophosphates and Carbamates**

1. Mild poisoning
  - a. Fatigue
  - b. Headache
  - c. Dizziness
  - d. Blurred vision
  - e. Excessive sweating and salivating
  - f. Stomach cramps and diarrhea
  
2. Moderate poisoning
  - a. Unable to walk
  - b. Weakness
  - c. Chest discomfort
  - d. Muscle twitches
  - e. Pupil constriction
  - f. Earlier symptoms more severe
  
3. Severe poisoning
  - a. Severe pupil constriction
  - b. Muscle twitches
  - c. Difficult breathing
  - d. Unconsciousness
  - e. Secretions from mouth and nose
  - f. Death if not treated

Note: Symptoms appear within a few hours after exposure. See a doctor immediately. If symptoms appear after more than 12 hours, they are probably caused by some other illness.

# Structure of Typical Motor Neuron

## Nerve Impulse Damage Caused By Insecticide Exposure



## Label Warnings About Allergic Reactions

From BRAVO® 500 label:

### **Precautionary Statements**

**NOTE TO USER:** This product may produce temporary allergic side effects characterized by redness of the eyes, mild bronchial irritation and redness or rash on exposed skin areas. Persons having allergic reaction should contact a physician.

### **Directions for Use**

**NOTE TO USER:** Wear long sleeve shirt, long pants, and gloves while mixing, loading, and applying this product.



## Worker Protection Standard (WPS) Accelerated Requirements

1. Label requirements
  - a. For anyone using pesticides in the production of agricultural plants.
  - b. When Worker Protection Standard (WPS) reference statements are on the pesticide label.
2. Personal Protective Equipment (PPE)
  - a. Must be worn by:
    - i. All early-entry workers who contact treated surfaces.
    - ii. All pesticide handlers.
  - b. Applies to owners of agricultural establishment and immediate family when using pesticides.
  - c. Early entry may occur only under the narrow exceptions allowed by the WPS.
3. Double Notification
  - a. Some pesticide labels require notification of workers verbally and with signs posted at entrance to treated area.

- b. Look for a statement similar to the following in Agricultural Use Requirements of label:  
*“Notify workers of the application by warning them verbally and by posting warning signs at entrances to treated areas.”*

#### 4. Verbal warning

##### a. Components

- i. Location and description of treated area.
- ii. Time during which entry is restricted.
- iii. Notice not to enter treated area until restricted-entry interval has expired.

##### b. All workers must receive a verbal warning.

##### c. No need to give verbal warning to any worker:

- i. On farm, forest, or nursery who will not be in treated area or walking within 1/4 mile of treated area during time of pesticide application or restricted-entry interval.
- ii. Not in greenhouse during time of pesticide application or restricted-entry interval.
- iii. Who applied, or supervised pesticide application, and is aware of information required in verbal warning.

5. Treated area posting
  - a. Post signs at usual points of worker entry to treated areas.
  - b. Signs
    - i. Must meet WPS criteria.
    - ii. Available from agricultural sign producers.
  - c. No need to post treated areas if:
    - i. No workers on farm, forest, or nursery will be in treated area or walking within 1/4 mile of treated area during time of pesticide application or restricted-entry interval.
    - ii. No workers will be in the greenhouse during time of pesticide application or restricted-entry interval.
    - iii. The only workers for whom posting is needed, applied or supervised the application of the pesticide and are aware of information required in oral warning.
    - iv. The only workers are immediate family members.

6. Restricted-Entry Interval (REI)
  - a. REI is the time after pesticide application during which entry into the treated area is limited.
  - b. Based on toxicity of active ingredient.
  - c. Some labels require a long REI for arid areas.
    - i. Example: 72 hours in outdoor area where average annual rainfall is less than 25 inches.
    - ii. Get rainfall information from weather bureau.
  - d. Exceptions to REI
    - i. Early entry with no contact.
    - ii. Early entry with contact for short-term, emergency, and special tasks.
7. No-contact early entry allowed if:
  - a. Inhalation exposure level listed on label or WPS ventilation requirements are met.

- b. Workers will not contact pesticide residues on crops or weeds, in soil or planting medium, in irrigation water or standing water, or in air.
- c. Situations where worker is not expected to contact residues
  - i. Worker is wearing footwear and is walking in pathway through treated area where plants or treated surfaces cannot brush against or drip pesticide onto the worker.
  - ii. Worker is in open-cab vehicle in treated area where plants or treated surfaces cannot brush against or drip pesticide onto the worker.
  - iii. Worker is not touching or disrupting soil subsurface after pesticide has been incorporated or injected into the soil.
  - iv. Worker is in enclosed cab on a truck, tractor, or other vehicle.
  - v. Note: Personal protective equipment is not required for non-contact early entry workers.

8. Early entry with contact
  - a. Allowed for:
    - i. Short-term tasks that last less than 1 hour and do not involve hand labor.
    - ii. Specific tasks approved by EPA through a formal exception process.
    - iii. Tasks required by an agricultural emergency.
  - b. Procedure for early entry
    - i. Wait at least four hours after pesticide application before entering treated area.
    - ii. Wait until inhalation exposure level listed on label has been reached.
    - iii. Spend no more than one hour in a 24-hour period on short-term early-entry tasks.
  - c. Workers may enter treated area before end of restricted-entry interval to do short-term jobs that do not involve hand labor, if they wear the PPE required by the label for early entry.

9. Handling tasks
  - a. Entering enclosed or outdoor fumigated areas to ventilate, remove coverings, or measure air concentration levels.
  - b. Only appropriate handlers can perform those tasks.
  - c. Operating, moving, or repairing irrigation equipment not used to apply pesticides is not considered hand labor.
10. EPA-approved exceptions to REI
  - a. Formal regulatory process for considering additional exceptions.
  - b. Approved exceptions are published in the Federal Register.
  - c. EPA informs State pesticide agencies, Cooperative Extension Service, industry and worker associations.
  - d. Check updated list of approved exceptions.

11. Agricultural emergency
  - a. Must be declared by State, Tribal, or Federal agency having jurisdiction during floods, hurricanes, tornadoes, freeze, or frost.
  - b. Applicator must decide if emergency actually exists for areas under restricted-entry interval.
  - c. Conditions that must be met before allowing workers in treated area during restricted-entry interval:
    - i. You could not have anticipated circumstances that led to emergency.
    - ii. You had no control of the circumstances that led to the emergency.
    - iii. If early entry does not occur, the loss of profit will be greater than the loss expected on the basis of experience and variation in crop yield. Mismanagement cannot be considered in determining loss.

For more information, see the EPA manual, *Worker Protection Standards: How to Comply*.



## Checklist For Section Five

### SLIDES

- Handling, Storage, and Disposal of Pesticides
- Always Wear the Right Stuff

### AV EQUIPMENT

- Slide Projector
- Extension cords
- Adapter plugs for 3-prong cords
- Overhead projector

### ADDITIONAL ITEMS

- Protective clothing and equipment
- First aid kit

## Handling Pesticides Safely

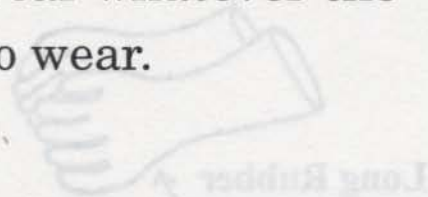
- EXPLAIN** Protective Clothing and Equipment. See pp. 174-178.
- EXPLAIN** Transporting and Storing Pesticides. See pp. 179-182.
- EXPLAIN** Hazardous Waste Management. See p. 183.  
"The key is waste minimization--producing as little waste as possible--because federal waste disposal regulations are complicated. Following those regulations consumes a lot of your time and money. The more waste you generate, the more complicated the regulations become."
- EXPLAIN** Pesticide Disposal. See p. 184-185.
- EXPLAIN** Mixing and Loading Pesticides. See pp. 186-187.  
"Mixing and loading pesticides is more hazardous than applying the pesticide because during the mixing and loading process, the pesticides are the most concentrated."
- EXPLAIN** Handling and cleaning work clothing. See p. 188.
- EXPLAIN** First Aid Supplies for Pesticide Exposure. See p. 189.
- CONDUCT** Practice Exam: Part B. See pp. 190-195. Allow 40 minutes. Explain that the purpose of this exam is to find out how much was learned in the training course. This is a follow-up to the exam given at the beginning of the course. "Before" and "after" scores will be compared to find out if the course is effective. Exam scores do not go into Department of Agriculture records.

**SECTION 5:  
HANDLING PESTICIDES SAFELY**

**Protective Clothing and Equipment  
Transporting and Storing Pesticides  
Hazardous Waste Management and Disposal  
Mixing and Loading Pesticides  
Laundry  
First Aid for Pesticide Poisoning  
Practice Exam**

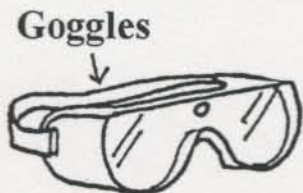
## Protective Clothing

1. Protective clothing includes:
  - a. Hat.
  - b. Long-sleeved shirt.
  - c. Long pants.
  - d. Socks and shoes.
2. You are legally obligated to wear whatever the pesticide label requires you to wear.
3. Wear clean clothes daily.
4. Have an extra set of clean work clothes available in case you contaminate the ones you are wearing.
5. Waterproof head covering keeps pesticides off the applicator's head
  - a. Plastic hard hat (some with wide brim) or bump cap.
  - b. Hood.
6. Liquid-proof boots keep pesticides off feet and lower legs
  - a. Unlined.
  - b. Knee length.
  - c. Keep trouser cuffs outside boots.
  - d. Shoe covers.

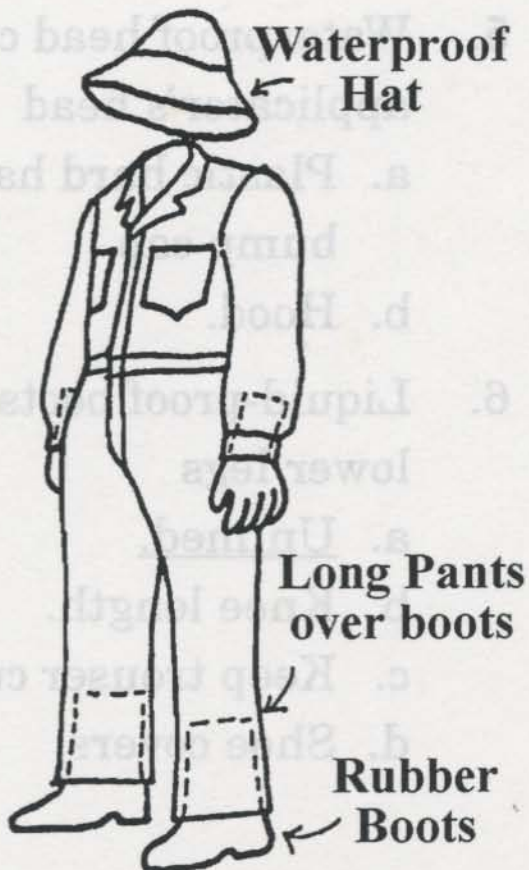


Protective Clothing

# Protective Equipment



## Protective Clothing



## Protective Equipment

1. Protective equipment includes:
  - a. Liquid-proof gloves.
  - b. Liquid-proof apron.
  - c. Goggles and face shield.
  - d. Respirator.
  - e. Liquid-proof clothing.
2. Wash and store properly to protect against:
  - a. Sunlight (UV radiation).
  - b. Solvents.
  - c. Contamination.
3. Liquid-proof gloves
  - a. Keeping pesticides off hands and forearms reduces exposure by 90%.
  - b. Unlined and elbow-length.
  - c. Glove types: Natural rubber, vinyl, neoprene, nitrile, Viton.
  - d. Thickness: Disposable, medium thickness, heavy-duty.
  - e. Shirt sleeves outside of gloves, roll cuff on gloves.
  - f. Check for leaks.
  - g. Time between glove changes affected by glove type, thickness, amount of use, and chemicals.
  - h. Rinse gloves before taking them off.

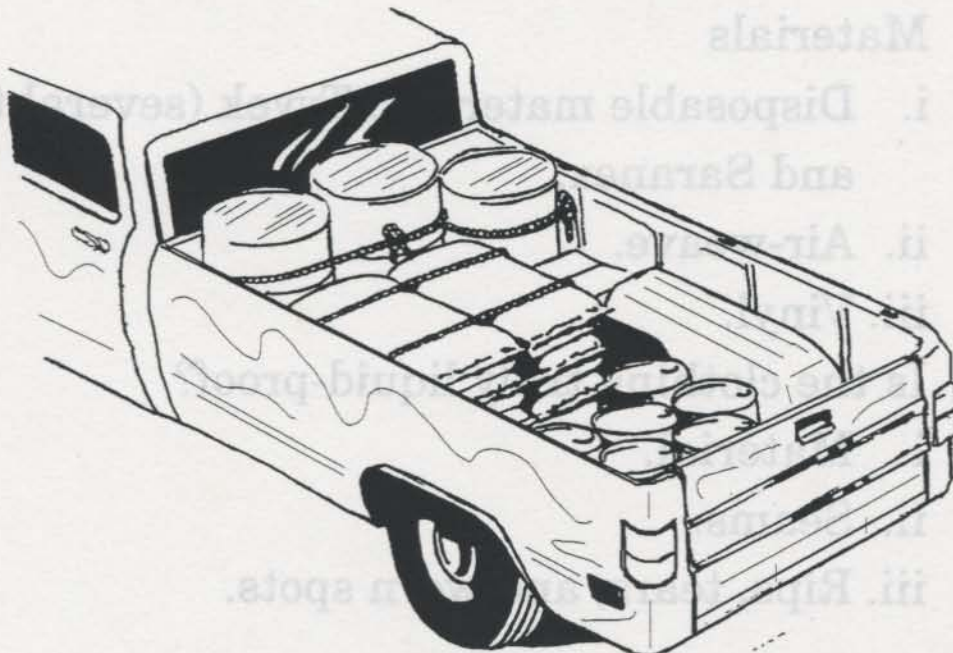
4. Liquid-proof apron
  - a. Keeps pesticides off front of body.
  - b. Covers body from chest to knees.
5. Goggles and/or face shield
  - a. Fogging
  - b. Vented vs. unvented
  - c. Do not wear contact lenses; wear glasses.
6. Respirators
  - a. Filter out pesticides.
  - b. Protection from:
    - i. Dusts.
    - ii. Vapors and fumes.
    - iii. Low oxygen.
  - c. Types of respirators
    - i. Particle mask: No vapor protection.
    - ii. Two-stage cartridge respirators
      - Filter pad for dusts
      - Activated carbon filter for vapors
    - iii. Chemical cartridge (small capacity)
      - Half-face
      - Full-face
    - iv. Cannister gas mask (large capacity)

- d. Critical buying and fitting choices
    - i. Different size face pieces: S, M, L.
    - ii. Adjustable straps.
    - iii. Wearer's health (pulmonary function test).
    - iv. Facial hair.
  - e. Replacement parts are not interchangeable; Brand X cartridges should not be used with Brand Y face-piece.
  - f. Maintenance
    - i. Check and replace cartridges.
    - ii. Make sure valves do not leak.
    - iii. Repair or replace broken straps.
    - iv. Wash and store according to instructions.
7. Liquid-proof clothing
- a. Jacket and pants vs. coverall type
  - b. Materials
    - i. Disposable materials: Tyvek (several types) and Saranex.
    - ii. Air-weave.
    - iii. Vinyl.
  - c. Is the clothing truly liquid-proof?
    - i. Material.
    - ii. Seams.
    - iii. Rips, tears, and worn spots.



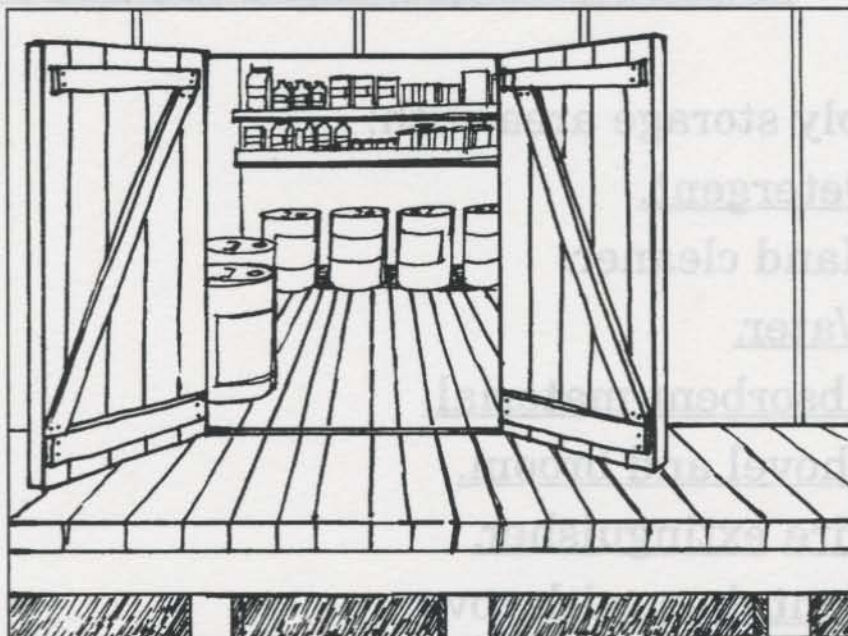
## Transporting Pesticides

1. Do not keep pesticides in same compartment with food, feed, clothing, or people. Best place is in the back of a truck.
2. Secure containers in upright position. Tie down or wedge.
3. Keep containers tightly closed and labeled.
4. Protect paper or cardboard containers from rain or moisture.
5. Pack glass containers carefully to prevent breakage.
6. Do not leave pesticides in unattended vehicles.



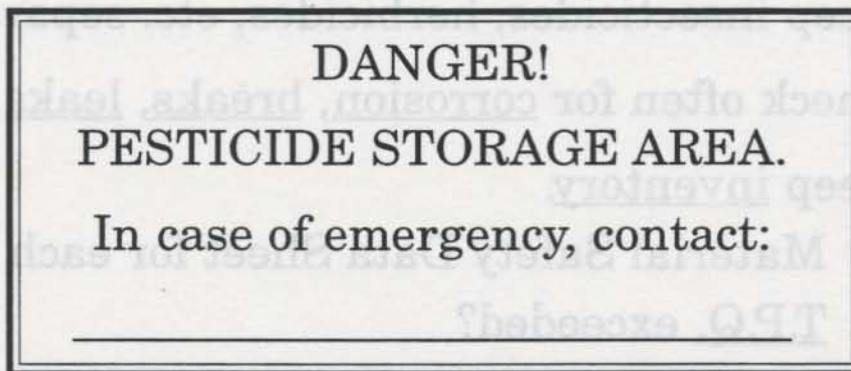
## Storing Pesticides

1. Look on pesticide label for storage directions.
2. Never store near or with food, feed, clothing.
3. Keep away from areas occupied by people (offices, lunch rooms, restrooms, etc.).
4. Keep pesticides in original containers.
5. Do not remove labels. Labels should be readable.
6. Separate pesticides from fertilizers.
7. Keep insecticides, herbicides, etc. separate.
8. Check often for corrosion, breaks, leaks, tears.
9. Keep inventory.
  - a. Material Safety Data Sheet for each pesticide.
  - b. T.P.Q. exceeded?



## Safe Pesticide Storage Areas

1. Storage cabinet, cage, shed, or building should be:
  - a. Locked
  - b. Dry
  - c. Properly illuminated inside.
  - d. Well ventilated.
  - e. Organized: Liquids separate from solids.
  - f. Clean: Remove rubbish to reduce fire hazard.
  - g. Identified with a sign on the entrance:



2. Supply storage area with:
  - a. Detergent.
  - b. Hand cleaner.
  - c. Water.
  - d. Absorbent material.
  - e. Shovel and broom.
  - f. Fire extinguisher.
  - g. Container with cover.

## Sample Storage Directions

From the BENOMYL 50W label:

### **CHEMICAL HAZARD:**

Keep away from fire or spark. *Never allow Benomyl 50W to become wet during storage.* This may lead to certain chemical changes which will reduce the effectiveness of Benomyl 50W as a fungicide.

## Hazardous Waste Management

1. Hazardous waste includes any pesticide that is not used according to the label directions.
2. Examples of hazardous waste
  - a. Excess spray mix.
  - b. Residue in empty containers.
  - c. Unwanted pesticides still in container.
3. Generate as little waste as possible.
4. Effects of improper pesticide disposal
  - a. Point source pollution
    - i. Identifiable location of source
    - ii. Examples: Pesticide spilled into stream, or a leaking container in a poorly managed storage site.
  - b. Non-point source pollution
    - i. Small amount of contaminants from multiple locations within a large area.
    - ii. Examples: Street run-off into storm drains and chemicals leaching into groundwater.

## Pesticide Disposal

1. You are responsible for proper disposal.
2. Unwanted pesticides
  - a. Example: Concentrates in original containers.
  - b. Buy only what you can use in a year.
  - c. Give away to responsible people or disposal agency.
3. Excess spray mix
  - a. Prevent the problem with proper calibration.
  - b. Mix only what you can use.
  - c. Uses for excess spray
    - i. On border of the crop.
    - ii. On another registered crop, animal or site.
4. Empty containers
  - a. Triple rinse.
  - b. Do not reuse. Break, crush, or puncture to prevent reuse.
  - c. Dispose of in sanitary landfill.
  - d. Never pour any type of pesticide into a sink, drain, toilet, storm drain, or dry stream bed.
  - e. Do not burn paper or plastic containers that have held pesticides.

## Pesticide Disposal Instructions

From the LORSBAN® 50W label:

**PESTICIDE DISPOSAL:** Wastes resulting from the use of this product may be disposed of on site or at an approved waste disposal facility.

From the LANNATE® L label:

**DISPOSAL:** Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal Law. If these wastes cannot be disposed of by *use according to label directions*, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

## Mixing and Loading Pesticides

1. Do not work near
  - a. Ponds, streams, wells,
  - b. Children, pets, livestock.
2. Clean tank and spraying system.
3. Mark measuring spoons and cups clearly
  - a. "FOR POISONS ONLY"
  - b. "POISON" and skull-and-crossbones picture.
4. Warn others before using highly toxic insecticides or nematicides. Let them know where you will be working.
5. Wear gloves.
6. Read the label
  - a. Identify required protective clothing and equipment.
  - b. Mixing and loading instructions
    - i. Do not mix chemicals if label prohibits it.
    - ii. Know sequence of adding chemicals to mixture.



7. When opening containers
  - a. Keep containers below eye level.
  - b. Cut open with knife or scissors; do not tear.
  - c. Avoid getting dust in face when opening, closing, or pouring from bags.
8. Avoid splashing when pouring liquids.
9. When measuring or pouring pesticides stand with breeze blowing from side to side not from behind or front.
10. Beware of back-siphoning when filling a tank.
11. First put some water in the tank, then agitate according to label directions.
12. Make a slurry of wettable powders.
13. Dispose of empty containers properly.
14. Replace covers and close bags promptly
  - a. Prevents accidental spilling.
  - b. Reduces exposure to air, light, moisture, and dirt.
15. Wash / bathe when job is done.

## Laundry

1. Do not store or wash contaminated clothing with family laundry. Store in a plastic garbage bag until ready to wash.
2. Wear gloves when handling contaminated garments.
3. Pre-soak and wash with regular laundry detergent and hot water.
4. If possible, hang on clothes-line instead of using dryer.
5. Rinse washing machine or wash bucket.
6. If clothes are heavily contaminated, destroy and properly dispose of them.

## First Aid Supplies for Pesticide Exposure

1. Dish washing detergent
2. Water
3. Gloves
4. Tincture or syrup of ipecac
  - a. Induces vomiting
  - b. Use only when directed.
  - c. Check expiration date on label.
5. Cup for drinking.
6. Activated charcoal
  - a. Absorbs ingested poisons.
  - b. Available from drug stores.
7. Phone numbers
  - a. Family doctor.
  - b. 911
  - c. Nearest poison center or hospital.
8. Quarters to make phone calls.
9. Keep first aid kit available wherever pesticides are used.

TODAY'S DATE \_\_\_\_\_ NAME \_\_\_\_\_

## Practice Exam: Part B

**INSTRUCTIONS:** Use your own knowledge and the three sample labels provided by the instructor to answer the following questions. Please do not use notes. Otherwise we will not be able to accurately measure how much you have learned in this training course. Unless instructed to do otherwise, choose the best answer for each question.

1. Suppose an uncertified applicator applies a restricted-use pesticide under the "direct supervision" of a certified applicator. If the uncertified applicator violates the local pesticide law, enforcement action may be taken against:
  - a) the uncertified applicator only.
  - b) the certified applicator only.
  - c) the certified applicator; sometimes the uncertified applicator too.
  - d) the certified applicator's company or agency, but not a person.
  
2. The amended FIFRA (also known as FEPCA — the Federal Environmental Pesticide Control Act) is administered by the:
  - a) U. S. Dept. of Agriculture (USDA).
  - b) U. S. Dept. of Health and Human Services.
  - c) U. S. Environmental Protection Agency (EPA).
  - d) U. S. Dept. of Treasury (Alcohol, Tobacco and Firearms Div.)
  
3. Investigations of pesticide misuse are based on the "misuse statement". Copy the misuse statement from any of the labels.

***It is violation of federal law to use this product in a manner inconsistent with its labeling.***

4. What is the **common name** for Agricide?

***Benomyl***

5. What is the **signal word** for Agricide?

***Danger!***

6. Agricide's relative toxicity to people is:

- a) high.
- b) moderate.
- c) slight; low.
- d) zero; non-toxic.

7. When a **signal word** is assigned to a pesticide, the decision is based on:

- a) the pesticide's ability to soften plastics and linoleum or to discolor paint, concrete and other structural materials.
- b) how easily the pesticide decomposes (breaks down) when exposed to air, moisture or sunlight.
- c) the pesticide's effectiveness against the target pests named on the label.
- d) the pesticide's oral, dermal and inhalation toxicity and its eye and skin irritation ratings.

8. Which of these pesticide formulations is most easily absorbed through your skin?

- a) Wettable powder.
- b) Flowable.
- c) Emulsifiable concentrate.
- d) Water soluble liquid.

9. What is the first action you should take to help someone who has swallowed some Gramoxone Extra Herbicide?

**Induce vomiting by inserting finger in throat.**

10. What signs and symptoms should you look for in a person who has inhaled Gramoxone Extra Herbicide spray mist?

**Irritation or nose bleeds.**

11. List two phone numbers you could dial (or describe who you could contact) to get first aid information for helping a poisoning victim.

- a. 911
- b. Family doctor
- c. Poison control center
- d. Manufacturer's phone number from pesticide label

12. Under some conditions, it is **not** okay to induce vomiting in a person who has swallowed a pesticide. Name three.

- a. When victim is unconscious
- b. When victim is lying face up
- c. When the victim is having convulsions
- d. When pesticide label says not to
- e. When pesticide contains petroleum products or acidic or caustic substances

13. Which of these is recommended for use as an eye wash to rinse pesticide out of your eyes?

- a) Visine, Murine, or other similar eye drops.
- b) Water.
- c) Epsom salts with water (1 teaspoon per quart of water).
- d) Milk with water (2 tablespoons per quart of water).

14. What type of formulation is Metholate L?

**A water soluble liquid**

15. What is the "pre-harvest interval" for Agricide used on beans?

**14 days (28 days for lima beans)**

16. List 6 symptoms you may experience if you are poisoned by a **carbamate** insecticide.

Mild Poisoning

fatigue  
headache  
dizziness  
blurred vision  
excess sweat & saliva  
nausea & vomiting  
stomach cramps or diarrhea

Moderate Poisoning

unable to walk  
weakness  
chest discomfort  
muscle twitches  
constriction of pupils  
severe earlier symptoms

Severe Poisoning

unconsciousness  
severe pupil constriction  
mouth & nose secretions  
muscle twitches  
difficult breathing  
death if not treated

17. Which statements about the "re-entry statement" are true? (There is more than one answer.)

- a) It is printed on **some** pesticide labels.
- b) It is printed on **all** pesticide labels.
- c) It is printed in a booklet which you must obtain from your pesticide dealer.
- d) It is intended to protect agricultural field workers.
- e) It is intended to protect firefighters and related emergency and rescue workers.
- f) It tells how long unprotected persons must stay out of treated fields.
- g) It tells how long firefighters and related rescue and emergency workers must stay out of pesticide accident areas before re-entering without protective equipment.

18. "Calibration of your sprayer" means:
- calculating how fast your sprayer must move across the area you plan to treat in order to apply the desired amount of pesticide on the area; for example, 3 miles per hour.
  - knowing and adjusting the amount of spray mixture your sprayer will spray on an area; for example, gallons per acre or gallons per 1,000 square feet.
  - finding out, by trial and error, the correct amount of pesticide and water to mix together in the sprayer tank in order to get effective pest control.
  - observing the spray pattern and adjusting the height of the spray nozzle(s) in order to spray the target thoroughly.

19. COMPLETE THE FOLLOWING:

1 cup = 8 fluid ounces

1 pound = 16 ounces

1 acre = 43560 square feet

1 pint = 2 cups

1 gallon = 4 quarts

1 minute = 60 seconds

1 quart = 2 pints

20. Suppose you want to use Agricide to control powdery mildew in your rose field. Your sprayer tank can hold 30 gallons of spray mixture. How much Agricide should you weigh out to make one full tank of spray mixture? (Read label carefully.)

2.4 ounces

(SHOW HOW YOU GOT YOUR ANSWER.)

$$\frac{0.5 \text{ lb.}}{100 \text{ gal.}} = \frac{X}{30 \text{ gal.}}$$

$$X = \frac{0.5 \text{ lb.} \times 30 \text{ gal.}}{100 \text{ gal.}}$$

$$X = 0.3 \text{ lb.} \times 16 \text{ oz./lb.} = \mathbf{2.4 \text{ ounces.}}$$

21. Suppose it takes you 19 seconds (average) to treat 100 square feet of a field of parsley with Metholate L. How long would it take you to treat 1 acre of the same field of parsley?

138 minute(s)/acre

(SHOW HOW YOU GOT YOUR ANSWER.)

From problem # 19, 1 acre = 43560.

$$\frac{19 \text{ seconds}}{100 \text{ sq. ft.}} = \frac{X}{43560 \text{ sq. ft.}}$$

$$X = \frac{19 \text{ sec.} \times 43560 \text{ sq. ft.}}{100 \text{ sq. ft.}}$$

$$X = \frac{827640 \text{ sec.}}{100}$$

$$X = 8276.4 \text{ sec.} \times 1 \text{ min./60 sec.} = \mathbf{138 \text{ minutes.}}$$

22. Suppose the sprayer you are using to treat your field of parsley is calibrated to spray out 32 fl. oz. of spray mixture (average) in 15 seconds. How much spray mixture would you spray out in 1 minute?

1 gallon(s)/minute

1 minute = 60 seconds

$$\frac{32 \text{ fl. oz.}}{15 \text{ sec.}} = \frac{X}{60 \text{ sec.}}$$

$$X = \frac{32 \text{ fl. oz.} \times 60 \text{ sec.}}{15 \text{ sec.}}$$

$$X = \frac{1920 \text{ fl. oz.}}{15}$$

$$X = 128 \text{ fl. oz.} \times 1 \text{ gal./128 fl. oz.} = \mathbf{1 \text{ gallon.}}$$



23. REFER TO QUESTION #21 AND #22. How much spray mixture would you use to treat 1 acre of your parsley field?

138 gallon(s)/acre

(SHOW HOW YOU GOT YOUR ANSWER.)

$$\frac{138 \text{ min.}}{\text{acre}} \times \frac{1 \text{ gal.}}{\text{min.}} = 138 \text{ gal./acre}$$

24. (This question is separate from questions 21, 22, and 23.) Suppose the sprayer you are using to treat your parsley field can hold 100 gallons of spray mixture. Also suppose that you have calibrated the sprayer to apply 80 gallons of spray mixture per acre. What is the maximum amount of Metholate L you should measure out to make one full tank of spray mixture? (See Leafy Green Vegetables on the back of the Metholate L label.)

10 cup(s) + 0 fl. oz./100 gallon tank

(SHOW HOW YOU GOT YOUR ANSWER.)

The METHOLATE L label, the maximum dose is 4 pints per acre and for each acre of leafy green vegetables you need 80 gallons of spray mix.

$$\frac{4 \text{ pints METHOLATE L}}{1 \text{ acre}} \times \frac{1 \text{ acre}}{80 \text{ gal.}} = \frac{4 \text{ pints}}{80 \text{ gal.}}$$

$$\frac{4 \text{ pints}}{80 \text{ gal}} = \frac{X}{100 \text{ gal}}$$

$$X = \frac{4 \text{ pints} \times 100 \text{ gal}}{80 \text{ gal}}$$

$$X = \frac{400 \text{ pints}}{80}$$

$$X = 5 \text{ pints} = 10 \text{ cups.}$$