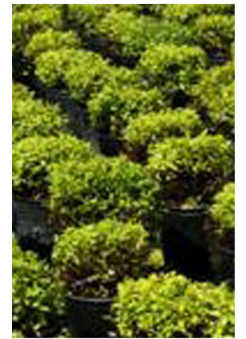
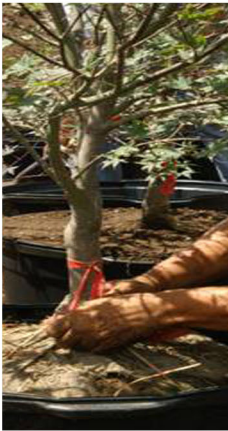


PESTICIDE SAFETY EDUCATION PROGRAM

Ohio Pesticide Applicator Study Guide

Nursery & Forest Crops



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PESTICIDE SAFETY EDUCATION PROGRAM

Ohio Pesticide Applicator Nursery and Forest Crops Student Workbook

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Ohio Private Pesticide Applicator Nursery and Forest Crops Study Guide

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Overview of Private Nursery & Forest Guide

This workbook was prepared by Ohio State University Extension for use as a self-study guide or in combination with an educational program. It has been developed to assist pesticide applicators in better preparing themselves for taking the Private Applicator Nursery & Forest Exam required for certification in Private Applicator Category 4.

The sample questions presented in this study guide will help the reader obtain a general understanding of nursery and forest pest problems, approaches to control and information needed in order to apply and use pesticides safely.

How to Use this Study Guide

The Ohio Pesticide Applicator Nursery & Forest Study Guide (OSU Bulletin 821-4) includes questions to help lead you through an overview of general forage and livestock topics and give you practice in answering multiple-choice questions.

- As you work through each unit, use a piece of paper to conceal each page of answers.
- Mark the response you feel is correct and continue with the next question until you complete that page.
- Once you have answered all of the questions on that page, look at the next page and check to see if your responses were correct.
- Read the explanation for each question, as important information is provided in these paragraphs.
- Some questions will refer to the sample pesticide labels found at the back of the study guide.

Preparing for the Exam

An emphasis of the Private Applicator Nursery and Forest Exam is reading and understanding the label. Parts and concepts of the label are addressed in all areas of the exam. Applicators should understand the importance of reading the label and how it relates to all aspects of pesticide application. A brief overview of the important concepts and issues addressed on the exam is presented here.

Nursery & Forest Crops Exam Outline

To help applicators prepare for the Nursery & Forest Crop Exam, the following is a brief outline of the important concepts addressed on the exam. Each of these topics is covered in the practice exam in this study guide.

Ohio Nursery & Forest Crops

(ranked in order of emphasis on exam)

1. Outdoor container grown ornamentals
2. Outdoor field-grown ornamentals
3. Christmas trees

Note: Category 4 does NOT include anything grown in a greenhouse, hoop house or high tunnel (these are category 5).

Pest Problems

(ranked in order of emphasis on exam)

1. Weeds/herbicides
2. Insects/insecticides
3. Disease/fungicides

General Pesticide Topics for Nursery and Forest Crops

Integrated Pest Management (IPM)

Applicators should be able to:

- Understand how the elements of Integrated Pest Management (IPM) fit into outdoor nursery and Christmas tree management
- Define economic thresholds
- Know that sanitation and cultural controls could improve plant health and reduce pesticide use
- Understand sanitation for potting mixes, seedlings and transplants
- Identify monitoring methods

Application and Equipment

Applicators should be able to:

- Understand common methods of application in outdoor nursery and Christmas tree situations:
 - Foliar
 - Drench
 - Granular
 - Container applications
 - Potting mixes with biopesticides
 - Band applications
- Understand precautions and methods for common application equipment:
 - Airblast
 - Backpack
 - Boom
- Do calculations for banding and broadcast applications
- Calculate application rates and tank fills

Reading Pesticide Labels

Applicators should be able to read and locate information on several labels, such as:

- Restricted Entry Interval (REI)
- Worker Protection Standards (WPS)
- Environmental hazards
- Maximum and minimum use rates for specific crops
- Active ingredient
- Personal Protective Equipment (PPE)

Worker Protection Standard (WPS)

Applicators should be able to:

- Identify growers who are required to follow the WPS
- Locate the WPS information on the label
- Know that the WPS includes compliance beyond the label
- Know definitions of worker and handler
- List and define five key components of the WPS:
 1. Central information
 2. Safety training
 3. Decontamination site
 4. Observe restricted entry intervals
 5. Notice of application

Primary Pests of Nursery and Forest Crops

Weed Control

Applicators should be able to:

- Understand the three types of life cycles for weed pests and understand the vulnerable stages as they relate control and management:
 - Annual
 - Biennial
 - Perennial
- Identify the differences between the types of weed pests:
 - Grassy
 - Broadleaf
 - Sedge
- Identify pictures of these weeds and their life cycle:
 - Broadleaves:
 - Bittercress
 - Yellow Woodsorrel
 - Prostrate spurge
 - Pearlwort
 - Canada Thistle
 - Field Bindweed
 - Grasses:
 - Crabgrass
 - Annual bluegrass
 - Orchard grass (Christmas trees)
 - Reed canary grass (Christmas trees)
- Compare these herbicide characteristics:
 - Preemergent vs. postemergent
 - Selective vs. nonselective
 - Contact vs. systematic
 - Residual vs. nonresidual
- Understand how herbicide products combine multiple characteristics

Insect and Mite Problems

Applicators should be able to:

- Understand vulnerable stages in insect and mite life cycles as they relate to control and management
- Identify these key sucking-piercing insects:
 - Scale
 - Mites
 - Leafhoppers and lacebugs
 - Adelgids (Christmas trees)
- Identify these key chewing insects:
 - Japanese beetles (outdoor nursery)
 - Bagworms/tentworms
 - Black vine weevil (outdoor nursery)
 - Pales Weevil and White Pine Weevil (Christmas trees)
 - Sawflies (Christmas trees)
- Know the distinguishing signs, symptoms and control options of key insects
- Know advantages and disadvantages of summer and dormant oils
- Understand some pests are quarantined and require compliance agreements with the Ohio Department of Agriculture if shipping out of the state.

Disease Management

Applicators should be able to:

- Recognize the main organisms that cause infectious disease
- Understand the disease triangle
- Know the difference between preventative and curative treatments
- Identify the distinguishing symptoms, signs, and control options of the following:
 - Phytophthora
 - Downy Mildew
 - Powdery Mildew
 - Leaf Spots
 - Anthracnose
 - Damping off
 - Seedling blights

Ohio Nursery and Forest Crops

Private Applicator Category 4

Following are some concepts of pest control in nursery and forest operations in Ohio. Specific information that the applicator needs to study for the exam will be covered in the study test questions in this study guide.

Private Applicator, Category 4, covers pesticide application to nursery and forest crops. The nursery and forest crops category is a combined category. The nursery portion is for field-grown ornamentals, perennials and woody plants. This also includes container-grown plants that are grown outside. It does not include plants grown in greenhouses, hoop houses or high tunnels. Enclosed or covered areas such as these are category 5. The forest crops portion is primarily Christmas tree production. It can also include private woodlands and tree plantings. The exam focuses on the broad pest management concepts involved with nursery and forest crop production. The technical information applicators need to know for the exam is covered in this study guide.

The exam focuses on pest groups that affect nursery and forest crop production. Some identification of individual pests may be required, but the applicator should focus on groups of insects, weeds and disease, symptoms of damage and the general control methods for these pests.

Studying for the Exam

Following are some general terms and concepts that applicators should know related to nursery and forest crop production. Additional pest management and pesticide application information is part of the study test questions in the next few sections of the study guide.

Integrated Pest Management (IPM)

Integrated Pest Management (IPM) is a planned strategy that utilizes appropriate combinations of pest control that is economically and environmentally sound. It involves identifying pests, determining the need for control methods and choosing the appropriate combination of control methods for the situation.

IPM Methods Include:

Cultural - changing conditions such as tillage, destroying crop residues, water management, pruning and spacing to promote plant health. These controls require an understanding of the pest and plants and are generally used at the most vulnerable stage of the pest's life. These practices help prevent pests from developing, which is a preventative action instead of a curative action to take care of the pest problem after it has started.

Sanitation - eliminating an environment that encourages pest reproduction will help control the pest population. Some sanitation practices include:

- Removing and properly dispose of all plant debris
- All containers, pots and trays and flats should be cleaned of all debris and properly sanitized
- Use clean potting mixes
- Only use disease-free plant material

Biological - use of natural enemies to control or reduce a pest population such as predators, parasitoids and pathogens.

Chemical - control that consists of a pesticide application. When used properly, pesticides are an effective and reliable management method. Pest identification and monitoring are important steps needed to determine if pesticides are necessary to control the pests.

Field Scouting

Field scouting is an important part of any IPM program to define the pest problem. Regular scouting of the crop needs to include:

- Identification of the pests
- Growth stage of the crop
- Location of the problem
- Threshold of the pest population
- Whether the pest population is increasing or decreasing

Accurate records are an important part of scouting and should be detailed written records of field location, field conditions, previous and current pest populations and control measures.

Economic or Action Thresholds

Thresholds are the levels of pest populations at which you should take action. Pest control thresholds may be based on aesthetic, health or economic considerations. The threshold is often set where potential damage from the pest would exceed the cost to control the pest.

Pesticide Resistance Management

When the same pesticide or same family of pesticides are used repeatedly, insect, disease or weed populations may develop resistance. Each time the pesticide is used it selectively kills the most susceptible individuals in the populations. Some individuals are able to withstand its effects. These survivors may be able to pass along this trait to their offspring. Continued use of the same pesticide may allow the resistant offspring to multiply and make the original pesticide application rate or spray schedule provide inadequate control. This is known as pesticide resistance.

Pests that are resistant have the genetic ability to survive a pesticide application and their offspring will inherit the resistance. Pests that are resistant to one pesticide will show resistance to chemically related pesticides with the same mode of action.

Resistance management will prevent or delay resistance development in the pest. The management program includes:

1. Using IPM principles of cultural, biological, mechanical and chemical control.
2. Rotating pesticides from different chemical families with different modes of action.
3. Using pesticides only when needed and using correct rates.

FRAC and IRAC

Resistance problems have increased since the introduction of highly effective compounds that have very specific sites of action. It is important to safeguard new chemistries as they become available. World-wide-action committees have been formed to keep pesticides effective and to limit crop losses if resistance does appear. The Fungicide Resistance Action Committee (FRAC) and the Insecticide Resistance Action Committee (IRAC) have classified fungicides and insecticides based on the mode of action of the chemistry.

The goal is to provide applicators with information to make good decisions on selecting fungicides and insecticides to manage resistance. Each product is assigned a group number which is printed on the label. When using insecticides and fungicides to delay the development of resistance:

1. Avoid repeated use of fungicides/insecticides from the same chemical group.
2. Alternate with products from other FRAC or IRAC codes.
3. Integrate other control methods (chemical, cultural, biological) into control programs.

Nursery and Forest Crops General Information

Integrated Pest Management

1. What term is used in IPM to indicate the level at which pests **MUST** be controlled?
 - a. Insect level
 - b. Disease severity
 - c. Economic threshold
 - d. Number of pests

2. Which statement best defines the principles of IPM:
 - a. IPM is a planned strategy of combining pest control tactics
 - b. IPM focuses its strategies on only biological controls
 - c. IPM promotes a single control for all pest problems
 - d. IPM is always the most cost-effective means of killing pests

3. Which of the following soil properties can influence pesticide performance?
 - a. Texture
 - b. pH
 - c. Moisture
 - d. All the above

4. Crop injury from herbicide carryover is more likely when:
 - a. Soil temperatures are lower than normal
 - b. Rainfall is lower than normal
 - c. A herbicide persists for a long time
 - d. All of the above

5. Sanitation controls such as removing plant debris, sanitizing containers and using clean potting mixes will reduce pest pressure by:
 - a. Improving plant health
 - b. Maintaining more vigorous plants
 - c. Reducing plant susceptibility to injury
 - d. All of the above

6. Using soil mix in containers that is weed-free is an examples of:
 - a. Texture
 - b. Sanitation
 - c. Barrier
 - d. None of the above

Nursery and Forest Crops General Information - Answers

Integrated Pest Management

- 1. Correct answer: C**
Explanation: Pest control thresholds may be based on aesthetic, health or economic consideration. The threshold is determined and set when the potential damage from the pest would exceed the ability or cost to control the pest. Economic thresholds depend on crop value and the cost to control. Therefore, a high value crop will have a lower economic threshold.
- 2. Correct answer: A**
Explanation: IPM is a planned strategy that utilizes appropriate combinations of pest control that is economically and environmentally sound. It involves identifying pests, determining the need for control methods and choosing the appropriate combination of control methods for the situation.
- 3. Correct answer: D**
Explanation: Soils that are higher in organic matter will tie up more herbicide than sandy soils and often require the higher rate per acre. Certain herbicides can become more or less available depending on soil pH which could affect weed control and possible carryover. Herbicides require soil moisture to be activated, so dry soil could cause poor weed control.
- 4. Correct answer: D**
Explanation: Plants can be damaged from pesticide residues remaining in the soil from previous agronomic, or other crops. This soil residue is called carryover, and a few herbicides can damage plants two years or more after they were used. All of the conditions listed increase the possibility of herbicide carryover problems. Additional conditions that will increase carryover problems are when the application rate is higher than normal, or the herbicide is applied later than normal. If the next crop is susceptible to carryover damage or is stressed during the growing season, damage could occur. Labels may state the required time you must wait after an application before planting certain crops.
- 5. Correct answer: D**
Explanation: Improving the overall health and vigor of the crop will make the plants less vulnerable to pest pressure and could keep pest from causing an unacceptable level of damage. These sanitation measures will help to eliminate an environment that encourages pest harborage.
- 6. Correct answer: B**
Explanation: Sanitation is important for weed control in containers. Preemergent herbicides will be more effective if there is clean soil in the posts. More weed seed will increase the number of weeds that could germinate.

7. Using disease - free transplants will help:
- Prevent spread of disease
 - Prevent spores remaining in the soil
 - Reduce some pesticide applications to control disease
 - All of the above
8. How does pesticide resistance develop?
- From a lack of proper crop variety selection
 - From repeated applications of the same pesticide
 - From repeated applications of pesticides with a common mode of action
 - Both b & c
9. Which insect would be less prone to pesticide resistance?
- A chewing insect
 - A sucking insect
 - An insect with a short life cycle
 - An insect with a long life cycle

Application and Equipment

10. To achieve leaf coverage for a foliar fungicide application, you should:
- Use higher pressure than for herbicides
 - Choose nozzles to create small droplets
 - Use sufficient gallonage
 - All of the above
11. If the sprayer is calibrated to the tractor travelling at 4 m.p.h., then slowing down at row ends to 2 m.p.h. means the rate of application will be:
- The same rate
 - Double the intended rate
 - Half the intended rate
 - None of the above
12. Applying herbicides along tree rows rather than covering the entire field is:
- Conventional spraying
 - Airblast spraying
 - Tree Spraying
 - Band spraying

7. **Correct answer: D**
Explanation: The fungi and bacteria that can cause disease are spread by microscopic spores. These spores can stick to surfaces of seeds and plant parts without being seen. In addition to affecting the transplants, the spores can also remain in the soil or plant debris to infect other plants.
8. **Correct answer: D**
Explanation: Pesticide resistance is when insect, disease or weed populations develop resistance when the same pesticide or family of pesticides are used repeatedly. Each time the pesticide is used, it selectively kills the most susceptible individuals in the population. Some individuals are able to withstand its effects. These survivors may be able to pass along this trait to their offspring. Continued use of the same pesticide may allow the resistant offspring to multiply. This is pesticide resistance.
9. **Correct answer: D**
Explanation: Resistant individuals have the genetic ability to survive an insecticide application. With continued use of the same insecticide the surviving population may be able to pass along this trait to their offspring. Insects with multiple generations per year accelerate that selection process and increase resistant populations. Resistance to pesticide application can develop in chewing and sucking insects.

Application and Equipment

10. **Correct answer: D**
Explanation: Adequate pressure and spray volume or gallonage is needed to penetrate and thoroughly cover plants. Fungicides and insecticides that are applied as a foliar spray need to completely cover both sides of the leaf to increase effectiveness. Special nozzles and higher pressure will create smaller droplets to increase leaf coverage. Some nozzles that are used for herbicides are not as effective for the higher volumes and spray pressure needed for fungicides and/or insecticides.
11. **Correct answer: B**
Explanation: Calibration is the process of measuring and adjusting the amount your sprayer is applying to the target area. Speed is one of the factors in calibration. So when the tractor speed is reduced by 50%, the rate of application is doubled because it takes twice as long to cover the same area.
12. **Correct answer: D**
Explanation: Herbicide applications can be applied in bands along tree rows rather than covering the entire field. So, only a fraction of an acre is covered and there is a cost savings and less pesticide used. Information on calibrating sprayers for band spraying is available at <http://ohioline.osu.edu/for-fact/0021.html> or OSU Extension Fact Sheet F-21, "Calibrating Boom Sprayers for Forestry Herbicide Application." Band spraying is primarily used with seedlings or small trees and plants.

13. The Christmas trees are in rows that are 24-inch bands. The center of the rows are 84-inches (7 feet) apart. The field size is 21 acres. The average size of the band spraying will be:
- 1 acre
 - 6 acres
 - 12 acres
 - 21 acres

WPS - Worker Protection Standard

14. When using pesticides for agricultural plant uses, growers with one or more workers will need to comply with which of the following provisions of the WPS.
- Pesticide safety training
 - Decontamination sites
 - Central information posting
 - All of the above
15. Under WPS, a worker is:
- A certified crop advisor
 - An employee who works in the field
 - A seed sales representative
 - None of the above
16. WPS requires employers to give oral warnings to workers when:
- The worker may be within 1/4 of a mile of the treated area
 - The pesticide application is being done
 - The REI is still in effect
 - All of the above

13. Correct answer: B

Explanation: The formula to use is:

$$\text{acres to spray} = \text{overall field size} \div \frac{(\text{distance between center of bands})}{\text{width of bands}}$$

Let's start with figuring the band proportion distance between:

$$\frac{\text{center of bands}}{\text{width of bands}} = \frac{84}{24} = 3.5$$

Then put this into the formula: acres to spray = 21 acres ÷ 3.5

acres to spray = 6 acres

With band spraying, you will need to figure the application rate for 6 acres. If using a boom sprayer, make sure the nozzles are set to only spray the tree rows.

WPS - Worker Protection Standard

14. Correct answer: D

Explanation: A farm with one or more employees who perform tasks related to the cultivation and harvesting of plants (including nursery stock and Christmas trees) must comply with all the generic provisions of the WPS if the workers will be in an area which has been treated with pesticides or under and REI within the last 30 days. Pesticide labels contain specific information under the section "Agricultural Use Requirements" on compliance with the WPS. In addition to general information, this section contains specific information about the required personal protective equipment that must be worn, type of notification that must be given to workers and the Restricted Entry Interval (REI) for that particular product.

15. Correct answer: B

Explanation: The Worker Protection Standard (WPS) defines a worker as anyone who is employed for any type of compensation and doing hand-labor tasks such as harvesting, pruning, weeding or watering relating to the production of agricultural plants on a farm, forest, nursery or greenhouse.

16. Correct answer: D

Explanation: All three situations require at least an oral warning for the workers. Growers may also use written warnings.

17. Under WPS, a pesticide handler or worker is involved with:
- Mixing, loading, transferring or applying pesticides
 - Handling opened containers of pesticides
 - Cleaning, handling, adjusting or repairing the parts of mixing, loading or application equipment that may contain pesticide residues
 - All of the above
18. During a restricted-entry interval (REI), a pesticide handler may enter a treated field to perform a handling task:
- Any time after a pesticide has been used
 - If he or she is trained and wearing personal protective equipment (PPE)
 - When the smell is gone
 - After spray has dried
19. When using a handheld or backpack sprayer what formulation should be used?
- Emulsifiable concentrates
 - Wettable powders
 - Soluble powders
 - Both a & c

Label

Refer to the Treasure G label at the back of the study guide for the following questions:

20. The REI (restricted entry interval) for Treasure G is:
- 8 hours
 - 12 hours
 - 24 hours
 - 36 hours
21. 150 lbs/acre of Treasure G is equal to:
- 2.30 lb/1000 sq ft
 - 3.45 lb/1000 sq ft
 - 3.85 lb/1000 sq ft
 - 4.60 lb/1000 sq ft
22. What rate of Treasure G should be used to control purslane in container grown pin oak?
- 2.3 lb
 - 3.5 lb
 - 4.6 lb
 - Do not apply

17. Correct answer: D

Explanation: The Worker Protection Standard (WPS) defines a pesticide handler as an employee who does all of the above tasks and may also:

- Assist with the application of pesticides, including incorporating the pesticide in the soil after the application has occurred
- Dispose of pesticides or pesticide containers
- Perform other pesticide related-tasks - for a complete listing, see the EPA How-to-Comply manual

18. Correct answer: B

Explanation: The amount of time for the REI will be on the label. Under WPS, a pesticide handler or worker may enter treated areas under the REI to perform specified tasks if they are trained, equipped with PPE and meets other requirements specified in the EPA How-to-Comply Manual.

19. Correct answer: D

Explanation: Handheld and backpack sprayers have very little if any agitation to keep the spray mixture in suspension. Emulsifiable concentrates and soluble powders require little to no agitation once mixed, but wettable powders require constant agitation.

Label

20. Correct answer: B

Explanation: The agricultural use requirements state, “do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours.”

21. Correct answer: B

Explanation: See chart on label page

22. Correct answer: D

Explanation: Treasure G is not labeled to be used on container grown pin oak. The label indicates the product can only be used on field grown pin oak.

23. Treasure G is a preemergent herbicide and requires:
- a. Soil temperatures above 80°F
 - b. At least 1/2 inch of irrigation or rainfall within three days
 - c. Grass to have been grown in the field prior
 - d. All of the above

23. Correct answer: B

Explanation: The general use precautions and restrictions portion of the label details the need of rainfall or irrigation within three days of applying Treasure G to activate the herbicide.

Nursery and Forest Crops Primary Pests of Ohio

Weeds

Fill in the blank to match the following weed definitions with the correct term:

Note: All questions on the exam will be multiple choice.

- | |
|------------------|
| a. Annual |
| b. Winter Annual |
| c. Biennial |
| d. Perennial. |

1. ____ Live for years

2. ____ Take two years to complete their life cycle

3. ____ Germinate, flower and die in a year or season

4. ____ Germinate in autumn or winter, live throughout the winter and then bloom in winter or spring

5. Applying a herbicide before weeds appear:
 - a. Postemergent weed control
 - b. Contact weed control
 - c. Preemergent weed control
 - d. All of the above

6. To control broadleaf weeds around Christmas trees, you would use a:
 - a. Selective herbicide
 - b. Nonselective herbicide
 - c. Bare ground product
 - d. None of the above

Nursery and Forest Crops Primary Pests of Ohio - Answers

Weeds

- 1. Correct answer: D**
Explanation: A perennial lives for more than two years and reproduces from seed, roots and underground reproductive parts. Control of perennials is most effective from bud to bloom. This is when the plant is moving nutrients down to the stem to store for the dormant period.
- 2. Correct answer: C**
Explanation: A biennial takes two years to complete its biological lifecycle. In the first year the plant grows leaves, stems and roots, and then it enters a period of dormancy over the colder months. Usually the stem remains very short and the leaves are low to the ground, forming a rosette. During the next spring or summer, the stem of the biennial plant elongates greatly, or “bolts,” then flowers, producing fruits and seeds before it finally dies.
- 3. Correct answer: A**
Explanation: An annual weed completes its life cycle in one year and dies.
- 4. Correct answer: B**
Explanation: Winter annuals grow and bloom during the cool season when most other plants are dormant or other annuals are in seed form waiting for warmer weather to germinate. Winter annuals die after flowering and setting seed. The seeds germinate in the fall or winter when the soil temperature is cool. Winter annuals typically grow low to the ground, where they are usually sheltered from the coldest nights by snow cover, and make use of warm periods in winter for growth when the snow melts. Some common winter annuals include henbit, deadnettle, chickweed and winter cress.
- 5. Correct answer: C**
Explanation: Preemergent herbicides are applied to the soil surface before weeds appear above ground. As weeds germinate and grow toward the surface, they make contact with the herbicide barrier in the soil and die. Rainfall is needed to move the chemical into the soil and activate it. Postemergent herbicides are applied after the weeds have emerged and most have only foliar activity. Contact herbicides are a type of postemergent herbicide.
- 6. Correct answer: A**
Explanation: Selective herbicides target only specific types of plants while leaving other plants unharmed. In general, a selective herbicide that targets broadleaf will not injure grasses or vice versa.

7. After applying a preemergent herbicide in plant containers, hand pulling weeds may:
 - a. Disrupt the herbicide barrier
 - b. Increase the effectiveness of the herbicide
 - c. Allow the herbicide to injure roots of the potted plant
 - d. Spread more weed seed to other pots
8. The conditions that affect the effectiveness of a residual herbicide in a Christmas tree plantation are:
 - a. Soil texture
 - b. Soil organic matter
 - c. Herbicide product
 - d. All of the above

Insects- Piercing-Sucking

Piercing-sucking insects feed by sucking juices out of the plant through tiny mouthparts that are shaped like straws.

9. These scale produce honeydew and move between branches and leaves:
 - a. Hard
 - b. Soft
 - c. Attached
 - d. Complete
10. The immature stage of scale insects is the most vulnerable to insecticides and called:
 - a. Crawlers
 - b. Nymphs
 - c. Caterpillars
 - d. Larvae
11. Mites can seriously damage plants because they:
 - a. Are small and difficult to see before damage is visible
 - b. Can reproduce very rapidly
 - c. Can build up resistance to pesticides quickly
 - d. All of the above
12. Mites damage plants by:
 - a. Sucking on plant juices
 - b. Chewing between the leaf surfaces
 - c. Chewing on leaf edges
 - d. Creating frass and honeydew

7. **Correct answer: A**
Explanation: The preemergent herbicide creates a barrier in the soil that the seed will not germinate or grow up through. Disturbing this barrier will allow seeds to germinate in the disturbed soil reducing the weed control.
8. **Correct answer: D**
Explanation: Soil texture, which is the amount of sand, silt and clay in the soil can affect herbicide efficacy. The higher the organic matter levels the higher the rate needed but also the less chance of leaching. Herbicides vary in their potential to persist in the soil also, depending on the climatic conditions.

Insects- Piercing-Sucking

9. **Correct answer: B**
Explanation: Both soft and hard scales can damage plants. Soft scales typically move between branches and leaves during their lifecycle. They also produce honeydew. Armored (hard) scale typically do not move to leaves during their lifecycle and also do not produce honeydew. Large infestations of scale suck out moisture, which can cause the plant to suffer stress, early loss of leaves and death of many small branches and twigs. Plants may be killed if they are under stress from other sources such as disease or drought.
10. **Correct answer: A**
Explanation: The crawler stage is when the scale is most susceptible to control. If the control is not done in the crawler stage, scale can damage the plant. Scale insects vary in their appearance as very small organisms. Adult scale are almost always immobile and permanently attached to the plant they have parasitized. They secrete a waxy coating for defense, which causes them to resemble fish scale. The waxy covering makes them resistant to insecticides, which are only effective against the nymph crawler stage.
11. **Correct answer: D**
Explanation: Mites are very tiny sucking insects that thrive in hot, dry weather when plants are stressed. They have a very short life cycle and many generations are produced rapidly. The multiple generations during a growing year could cause pesticide resistance.
12. **Correct answer: A**
Explanation: Mites are more related to spiders than insects. They generally live on the under sides of leaves of plants, where they may spin protective silk webs, and they can cause damage by puncturing the plant cells to feed.

Insects- Chewing

Insects with chewing mouthparts feed on leaves, stems, branches and trunks.

13. White pine weevil is best controlled in Christmas trees by pruning and burning infested leaders:

- a. Early spring
- b. Early summer
- c. Late fall
- d. Late winter

14. This insect defoliates plants by chewing on leaves:

- a. Mite
- b. Aphid
- c. Leafhopper
- d. Beetle



15. Identify the insect that leaves c-shaped notches on plant leaves.

- a. Black vine weevil
- b. leaf beetle
- c. Lacebug
- d. Oriental beetle



16. The larval of this insect are destructive because they chew unseen on the roots of plants:

- a. Black vine weevil
- b. Hard Scale
- c. Leafhopper
- d. Mites

17. Identify this insect that has sucking-mouth parts and moves by jumping or flying away:

- a. Aphid
- b. Leafhopper
- c. Lacebug
- d. Chaffer



18. Identify this insect:

- a. Lacebug
- b. Mites
- c. Webworms
- d. Loopers



Insects- Chewing

13. Correct answer: B

Explanation: The weevil will infest the terminal leader of the tree and girdle the stem. Christmas tree growers should check for dying terminals in June. To control the weevil, prune and burn infested leaders before mid-July. If the plantation is heavily infested, growers will need to spray as soon as the weather warms to control egg-laying adults and in late summer to control newly emerged adults.

14. Correct answer: D

Explanation: Beetles cause damage to plants. Japanese beetles, pictured here, can be very destructive. Beetles are leaf feeders and damage is usually seen as chewed leaf edges. Beetles can also skeletonize leaves where the area between the veins of the leaf are eaten leaving behind a skeleton.

15. Correct answer: A

Explanation: These c-shaped notches indicate possible black vine weevil damage. Adults that feed along leaf margins produce typical crescent shaped notches. Adult black vine weevils will feed on over 100 different kinds of plants including trees, shrubs, vines and flowers. It commonly infests containerized perennials in greenhouse and polyhouse production settings. Weevils are extremely damaging by girdling the roots and causing plant death.

16. Correct Answer: A

Explanation: Black vine weevils are especially destructive because the larvae chew unseen on the roots, permanently damaging the plant before they are noticed. The larvae thrive in wet, moist conditions, and feed on the stem of the plant, causing girdling.

17. Correct answer: B

Explanation: Leafhoppers are small sucking insects. Damage ranges from leaf stripping and distortion to hopper burn, which is a browning of the leaves. Damage from potato leafhoppers can be quite severe on some nursery grown trees. In addition to feeding injury, some species can transmit plant pathogens.

18. Correct answer: C

Explanation: Webworms create unsightly silken webs. The caterpillars eat the leaf surface between the veins, which makes the leaf look like a skeleton. Injury happens late in the growing season, and if the tree is not under previous stress, most of the injury should only be aesthetic. Many caterpillars will occupy one tent or web. Larvae feed within the protection of the silken web.

19. Identify this soft-bodied insect:

- a. Looper
- b. Leafminer
- c. Thrip
- d. Aphid



20. Identify this insect that develops underneath the bark of trees and shrubs:

- a. Borer
- b. Lacewing
- c. Weevil
- d. Garden beetle



21. Horticultural oils can be effective for controlling which of the following:

- a. Scale
- b. Lacebugs
- c. Bagworms
- d. Borers

22. Which of the following insects are generally easier to control because they are **NOT** protected within the plant at some stage?

- a. Leafminers
- b. Borers
- c. Aphids
- d. Nematodes

23. To control soft-bodied insects while plants are actively growing, you should use:

- a. Dormant oil
- b. Summer oil
- c. Heavy petroleum oil
- d. None of the above

24. What species of Christmas trees are sensitive to oil sprays?

- a. White pine
- b. Noble fir
- c. Blue Spruce
- d. Scotch pine

25. Adelgids are small insects that form galls on Christmas trees that potentially make the trees unsellable. When is the best time to make applications to control this insect?

- a. Early spring
- b. Early summer
- c. Late summer
- d. None of the above

- 19. Correct answer: D**
Explanation: Aphids are small, soft-bodied insects with long, slender mouth parts used to pierce stems, leaves, and other tender plant parts and suck out plant fluids. Aphids have many generations a year. Large populations cause curling, yellowing, and distortion of leaves and stunting of shoots. Aphids also produce large quantities of a sticky substance called honeydew. The honeydew turns black with growth of a sooty mold fungus.
- 20. Correct answer: A**
Explanation: Borer damage is caused by the larvae that go into the tree's bark and trunk to feed. Borer control needs to be done when the adult is laying eggs and before the larvae move to the center of the trunk.
- 21. Correct answer: A**
Explanation: Horticultural oils suffocate the insect. Oils are most effective on soft-bodied insects. Oils are most effective when the scale is in the crawler phase. Oil can also be used to control mites by smothering them.
- 22. Correct answer: C**
Explanation: Aphids spend their life on the plant surface and thus are easily contacted by the insecticide unlike those that are inside the leaf, soil or stem which generally protects them from contact sprays.
- 23. Correct answer:**
Explanation: Oils can be used to control soft-bodied insects, such as scale (crawler stage), aphids, and mites. However, when plants are actively growing, summer oils should be used because they are lighter and won't damage the plant. Dormant oils are usually heavier and are used during winter and early spring.
- 24. Correct answer: C**
Explanation: There are several plants that are sensitive to oil and can be damaged if oil sprays are used. Blue spruce and all spruces are sensitive along with Douglas-fir. Always consult the label for a list of sensitive plants.
- 25. Correct answer: A**
Explanation: Applications need to be made in the spring just before buds break. Dormant oil applications can be made in the late fall or early spring to control the adelgids. Heavy infestations may require oil or insecticide applications.

26. What is a cultural control that would be effective for controlling adelgids?
- a. Insecticide application
 - b. Extra fertilization
 - c. Mulching
 - d. Hand pruning
27. The Ohio Department of Agriculture has a quarantine for insect pests, such as emerald ash borer, gypsy moth, and others. which nursery growers:
- a. Must make sure stock to be shipped is pest-free
 - b. Have a compliance agreement if growing in a quarantine zone
 - c. If asked, allow an ODS nursery inspector to check the plants
 - d. All of the above

Fill in the blank to match the following insecticide definitions with the correct term:

Note: All questions on the exam will be multiple choice.

- e. Systemic
- f. Contact
- g. Residual contact
- h. Transliminar
- i. Stomach poison

28. ____ The spray must directly hit the insect for control
29. ____ The insecticide is taken up by the plant and distributed through all the growing points
30. ____ Spray that remains on the surfaces and controls insects that walk or feed on the surface
31. ____ Insecticide that controls only insects that feed on leaves
32. ____ Insecticides that need to be ingested for control

- 26. Correct answer: D**
Explanation: After hatching, adelgid nymphs move to the expanding buds of the trees and begin feeding. They form galls to protect themselves while they are feeding. The galls can be hand pruned, collected, and burned. The pruning needs to be done while the galls are green, before they open and the adults emerge.
- 27. Correct answer: D**
Explanation: Control of invasive species, such as emerald ash borer, gypsy moth, Asian longhorn beetle, and other insects, require nursery growers to only ship pest-free stock.
- 28. Correct answer: B**
Explanation: A contact insecticides can only control insects that are directly sprayed. If the insect does not come in contact with the spray, they will not be controlled. Contact insecticides are most effective on slow-moving insects such as caterpillars and scale in the crawler stage.
- 29. Correct answer: A**
Explanation: Systemic insecticides move throughout the plant to the leaves, trunk and other growing areas. Insects that feed on the leaves or in the trunk of the tree will be controlled. Timing of application of systemic is important so the insecticides moves through the tree or plant.
- 30. Correct answer: C**
Explanation: A residual contact insecticide will control insects that are directly sprayed and leave a residue on the surface of the plant. Insects that come in contact with the residue will also be controlled. However, the residual control is not long lasting on the plant surface.
- 31. Correct answer: D**
Explanation: Like systemic, translaminar insecticides move through the plant. The difference is translaminar insecticides only move to the leaf tissue and control insects that have piercing mouth parts. This includes aphids and mites.
- 32. Correct answer: E**
Explanation: Stomach poisons are most effective with caterpillar and beetles. The insect feeds on an insecticide-covered leaf and is immediately killed. It does not affect beneficial, or predator insects.

Disease

33. Which of the following approaches will **NOT** help control soil borne diseases in nurseries?
- Sterile soil
 - Foliar fungicides
 - Clean transplants
 - Fungicide soil drenches
34. Pathogens that cause diseases can be found in the air and:
- Rocks
 - Clouds
 - Rain
 - Soil
35. What causes infectious diseases in plants?
- Fungi
 - Bacteria
 - Viruses
 - All of the above
36. The three sides of the disease triangle are (1) host plant, (2) favorable environment and (3):
- Noninfectious
 - Pathogen
 - Control
 - Prevention
37. A preventative treatment is used to:
- Prevent a disease
 - Cure a disease
 - Stop symptoms that are showing
 - None of the above
38. Identify this disease that causes a white to gray powdery growth on leaves and stems:
- Scab
 - Damping off
 - Powdery mildew
 - Rust



Disease

33. Correct answer: B

Explanation: Foliar fungicides are only effective as protectants on plant foliage against leaf blights and other foliar diseases. The use of sterile soil for potted plants and clean transplants insure a good start after transplanting. Drenching of the root system with fungicides protect the plant from soil borne fungi.

34. Correct answer: D

Explanation: Diseases are caused by pathogens that live in the air or soil around the plants. These disease-causing organisms are common and will infect plants when conditions are right.

35. Correct answer: D

Explanation: Diseases are caused in plants by fungi, bacteria or viruses. Fungi and their spores can survive for long periods of time in the soil or on plants. Bacteria must remain in contact with the host plant, or organic matter like plant debris to survive. Viruses are spread by some insect vectors or by the movement of infected seeds, plants, plant parts or infested equipment.

36. Correct answer: B

Explanation: The disease triangle illustrates the three conditions that must exist for a disease to appear:

1. The host plant must be susceptible to the disease
2. Environmental conditions must be favorable
3. The pathogen must be present for the disease to invade the plant.

37. Correct answer: A

Explanation: Fungicides are most effective if used as a tool to **prevent** a disease. The fungicide is applied to the plant to create a protective barrier **before** a fungus can infect the plant. A fungicide barrier is most effective when symptoms may not be visible, but conditions for infection are favorable.

38. Correct answer: C

Explanation: Powdery mildew is found on a large range of plants. Powdery mildew will not kill the plant, but can cause some leaf deformity. Plants are more prone to powdery mildew in shaded, low-light and moist areas. Proper spacing and cultural practices to keep leaves dry will help reduce powdery mildew infection.

39. Identify this disease that is seen as masses of reddish-orange spores on the leaf surface:

- a. Rust
- b. Downy mildew
- c. Scab
- d. Phytophthora



40. Identify this disease that produces grayish, fuzzy looking spores, especially on lower-leaf surfaces:

- a. Scab
- b. Fungal leaf spots
- c. Anthracnose
- d. Downy mildew



41. Identify this disease that produces well-defined lesions on the leaf surface:

- a. Scab
- b. Fungal leaf spots
- c. Damping off
- d. Herbicide damage



42. The first symptoms of *Phytophthora* disease are:

- a. Easily seen with your eyes while walking plant rows
- b. May be below ground and/or under the bark
- c. Always on the leaves
- d. Always on the roots

43. *Phytophthora* diseased plants in the field:

- a. Usually do not appear in a uniform pattern
- b. Usually do occur in a uniform pattern
- c. All die
- d. Affected leaves fall off but plant does not die

39. Correct answer: A

Explanation: Rusts are considered one of the most dangerous diseases to horticulture. They generally do not kill the plant but can severely damage plant growth. Rust infection may occur several days or weeks before symptoms are seen. A preventative spray is needed during known infection periods which span from late spring to summer.

40. Correct answer: D

Explanation: Downy mildews can cause leaf spots, blights and distortions. Prolonged periods of leaf wetness promote spore germination. Proper plant spacing and increasing air circulation will help minimize spread of the disease. Fungicides may be used for prevention if wet and cool conditions can't be avoided.

41. Correct answer: B

Explanation: Depending on the host and pathogen involved, leaf spots can take on a variety of sizes, shapes, and colors. Leaf spot diseases are usually not serious unless they cause complete defoliation. If young seedlings are defoliated early in the growing season, they may not have enough food reserves in the roots to produce new leaves, and die. The most common type of leaf spot is circular and light to dark brown, but some leaf spots can grow into large blotches on mature leaves or appear as leaf blisters and tar spots.

42. Correct answer: B

Explanation: Many plants with *Phytophthora* root rot do not show above ground symptoms until summer. During hot, dry weather the plant does not have enough functional roots left to keep up with transpiration. Plants frequently wilt and collapse. To reduce the spread of *Phytophthora*, maintain sterilization practices during propagation. Fungicides may be needed as a preventative.

43. Correct answer: A

Explanation: *Phytophthora* root rot thrives best in production areas where water stands for long periods or where drainage is poor. The disease is spread by swimming spores in standing water or saturated soil.

Score Card

Number of Questions Answered Correctly	Percent Correct	Evaluation
60-66	>90%	<p><i>Excellent:</i> You have a very good understanding of areas addressed in this student workbook.</p>
53-59	>80%	<p><i>Good:</i> Be sure you understand those questions that you missed. It may help to read the study material again and re-answer the questions you missed.</p>
47-52	>70%	<p><i>Needs Improvement:</i> Your score indicates a borderline level of expertise. Be sure to re-read the study material and re-answer the questions you missed.</p>
0-46	<70%	<p><i>Study Needed:</i> Re-read the study material and work through sections of the workbook again.</p>

Additional Study Aids

Nursery and Forest Label - Treasure G..... page 40
(to be used with questions earlier in the study guide)

Treasure G

Specialty Herbicide

A selective preemergence herbicide for control of certain broadleaf weeds and annual grasses in:

- Landscape Ornamentals
- Christmas Tree Plantations
- Container Grown Ornamentals
- Field Grown Ornamentals
- Groundcovers/Perennials
- Non-Bearing Fruit and Nut Trees
- Non-Bearing Vineyards
- Non-Cropland

Active Ingredients:

Nalurin.....	2.0%
Benoxa.....	0.5%
Other Ingredients.....	97.5%
Total.....	100.0%

Contains 1.25 lb active ingredient per 50 lb bag.

EPA Reg. No.: XXXX-XX

Keep Out of Reach of Children

CAUTION PRECAUCION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

Precautionary Statements

Hazards to Humans and Domestic Animals

CAUTION

Causes Moderate Eye Irritation • Harmful If Swallowed Or Inhaled • Prolonged Or Frequently Repeated Skin Contact May Cause Allergic Reaction In Some Individuals

Avoid breathing dust or spray mist and contact with eyes or clothing. Wash thoroughly with soap and water after handling.

First Aid

If in eyes: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing eye. Call a Poison Control Center or doctor for treatment advice.

If swallowed: Call a Poison Control Center or doctor immediately for treatment advice. Have a person sip a glass of water if able to swallow. Do not induce vomiting unless told to do so by a Poison Control Center or doctor. Do not give anything by mouth to an unconscious person.

If inhaled: Move person to fresh air. If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably mouth-to-mouth if possible. Call a Poison Control Center or doctor for further treatment advice.

Have the product container or label with you when calling a Poison Control Center or doctor or going for treatment. You may also contact 1-800-xxx-xxxx for emergency medical treatment information.

Personal Protective Equipment (PPE)

Applicators and other handlers must wear:

- Long-sleeved shirt and long pants
- Shoes plus socks

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

Agricultural Use Requirements

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. Refer to label booklet under "Agricultural Use Requirements" in the Directions for Use section for information about this standard.

Refer to inside of label booklet for additional precautionary information including Directions for Use.

Notice: Read the entire label. Use only according to label directions.

Treasure G

Before using this product, read **Warranty Disclaimer, Inherent Risks of Use, and Limitation of Remedies at end of label booklet. If terms are unacceptable, return at once unopened.**

In case of emergency endangering health or the environment involving this product, call 1-800-xxx-xxxx. If you wish to obtain additional product information visit our web site.

Agricultural Chemical: Do not ship or store with food, feeds, drugs or clothing.

Engineering Controls

When handlers use closed systems or enclosed cabs in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 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.
- Users should remove PPE immediately after handling this product. As soon as possible, wash thoroughly and change into clean clothing.

Environmental Hazards

This pesticide is extremely toxic to freshwater marine, and estuarine fish and aquatic invertebrates including shrimp and oyster. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Do not apply in a manner which will directly expose canals, lakes, streams, ponds, marshes or estuaries to aerial drift. Do not contaminate water when cleaning equipment or disposing of equipment washwaters.

Directions for Use

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

Read all Direction for use carefully before applying.

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 of this label about personal protective equipment (PPE), and restricted entry interval. The requirements in the box only apply to uses of this product that are covered by the Worker Protection Standard.

Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 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
- Shoes plus socks

Non-Agricultural Use Requirements

The requirements in this box apply to uses of this product that are NOT within the scope of the Worker Protection Standard for agricultural pesticides (40 CFR Part 170). The WPS applies when this product is used to produce agricultural plants on farms, forests, nurseries, or greenhouses.

For applications in landscape settings and in non-cropland sites, do not enter or allow others to enter the treated area until dusts have settled.

Storage and Disposal

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

Pesticide Storage: Store in original container only. In case of spill, contain material and dispose as waste.

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

Nonrefillable rigid containers 5 gallons or less:

Container Handling: Nonrefillable container. Do not reuse or refill this container.

Treasure G

Triple rinse or pressure rinse container (or equivalent) promptly after emptying. **Triple rinse** as follows: Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container 1/4 full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times. **Pressure rinse** as follows: Empty the remaining contents into application equipment or a mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container, and rinse at about 40 psi for at least 30 seconds. Drain for 10 seconds after the flow begins to drip. Then offer for recycling if available or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

Refillable rigid containers larger than 5 gal:

Container Handling: Refillable container. Refill this container with pesticide only. Do not reuse this container for any other purpose. Cleaning the container before final disposal is the responsibility of the person disposing of the container. Cleaning before refilling is the responsibility of the refiller. To clean the container before final disposal, empty the remaining contents from this container into application equipment or a mix tank. Fill the container about 10% full with water and, if possible, spray all sides while adding water. If practical, agitate vigorously or recirculate water with the pump for two minutes. Pour or pump rinsate into application equipment or rinsate collection system. Repeat this rinsing procedure two more times. Then offer for recycling if available, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures allowed by state and local authorities.

General Information

Treasure G specialty herbicide is a preemergence product for control of certain broadleaf weeds and annual grasses in container and landscape ornamentals, nursery stock, Christmas trees, groundcovers/perennials, non-bearing fruit and nut trees, non-bearing vineyards and non-cropland areas. Apply Treasure G anytime prior to germination of target weeds, or immediately after cultivation. Length of weed control will vary with rate of Treasure G applied, weed population, potting media or soil conditions, temperature, watering regime, and other factors. Following application, user should monitor and observe level of weed control over time to determine when additional applications may be needed.

General Use Precautions and Restrictions

Treasure G controls weeds growing from seed. Treasure G does not control established weeds, weeds growing from stolons, rhizomes, or root pieces. Existing weeds should be controlled by cultivation or with postemergence herbicides. Weed residues, prunings and trash should be removed or thoroughly mixed into soil prior to treatment. Soil should be in good condition and free of clods at the time of application. A single rainfall or sprinkler irrigation of 0.5 inches or more, or flood irrigation is required to activate Treasure G. Optimum weed control is obtained when Treasure G is activated within 3 days of application. If rainfall or irrigation does not occur within 3 days of application and tillage is possible, Treasure G may be activated using cultivation equipment capable of uniformly mixing the herbicide into the upper 1 to 2 inches of soil. Failure to activate Treasure G within 3 days of application may result in erratic control of annual grasses. Do not apply when wind conditions favor drift of Treasure G granules from the target area.

Repeat applications at 150 lb per acre and higher should not be made sooner than 60 days after a previous application of Treasure G. Do not apply over 600 pounds per acre total of Treasure G within a 12-month period.

Tolerance of Turfgrass Adjacent to Ornamental Plantings:

Accidental application to turf may occur when applying Treasure G to ornamental plantings. Treasure G is not recommended for weed control in turfgrasses, but turfgrasses are generally tolerant to small amounts of this product that fall outside of the intended area of application.

Do not aerially apply Treasure G.

Treatment Species Not Listed on the Label for Treasure G:

Users who wish to use Treasure G on plant species not recommended on this label may determine the suitability for use by treating a small number of such plants at a recommended rate. Prior to treatment of larger areas, the treated plants should be observed for any sign of herbicidal injury for during 30 to 60 days of normal growing conditions to determine if the treatment is safe to the target plant species. The user assumes responsibility for any plant damage or other liability resulting from use of Treasure G on plant species not recommended on this label.

Application Instructions

Apply Treasure G using a drop or rotary-type spreader designed to apply granular herbicides or insecticides. Calibrate application equipment prior to use according to manufacturer's directions. Check frequently to be sure equipment is working properly and distributing granules uniformly. Do not use spreaders that apply material in

(SAMPLE LABEL - FOR EDUCATIONAL USE ONLY)

Treasure G

narrow concentrated bands. Avoid skips or overlaps as poor weed control or crop injury may occur. More uniform application may be achieved by spreading half of the required amount of product over the area and then applying the remaining half in swaths at right angles to the first.

Application Techniques for Applying Treasure G

- When using a drop-type spreader, a splashboard mounted under the hopper will provide more even granule distribution.
- A chain fastened to the side of the spreader and allowed to drag on the soil surface can be used to mark the edge of the treated swath and help prevent skips or overlaps.
- For treating smaller areas or rows of nursery stock or ornamental beds, a hand held or push-type rotary applicator such as a whirlybird or cyclone unit is recommended. For hand held units, walk and turn the crank at a constant rate of speed.
- A shaker-type applicator made from a small container with holes punched in the bottom is recommended for small, difficult to treat areas. Carefully measure the amount of product needed to avoid over application.
- The weight-to-volume conversion table below provides equivalent amounts of Treasure G.

Broadcast Rates

Rate	Amount/1000 sq ft		Amount/100 sq ft	
	lb/Acre	(lb)	(quarts)	(cups)
100	2.30	1.75	0.23	0.7
150	3.45	2.60	0.35	1.0
200	4.60	3.50	0.46	1.4

1 lb of Treasure G = 0.75 quart = 3 cups

Spreader Settings as a Guide for Calibration

Note: These settings are provided as a suggested starting point in calibrating each individual spreader. Since no two spreaders are alike, these settings are not intended to be used as absolute recommendations by the spreader manufacturer.

Speed (mph)	Settings for Warren T-7 11 Spreader		
	Target Rate of Treasure G		
	100 lb/acre	150 lb/acre	200 lb/acre
2.0	2 1/2	3 1/4	3 3/4
2.5	3	3 1/2	4 1/4
3.0	3 1/4	4	5

Warren spreader settings are displayed in half-number increments only. The suggested settings that indicate quarter settings can be accomplished by placing the calibration arm between the half number marks on the spreader.

Weeds Controlled or Suppressed

Weeds controlled when applied at 100 lb per acre (2.3 lb per 1000 sq ft):

Common Name	Scientific Name
aster, slender	<i>Aster exilis</i>
barnyardgrass	<i>Echinochloa crus-galli</i>
bluegrass, annual	<i>Poa annua</i>
celery, wild	<i>Apium leptophyllum</i>
chickweed, common	<i>Stellaria media</i>
clover, white	<i>Trifolium repens</i>
crabgrass	<i>Digitaria</i> spp.
foxtail, yellow	<i>Setaria glauca</i>
groundcherry, lanceleaf	<i>Physalis lanceifolia</i>
henbit	<i>Lamium amplexicaule</i>
horseweed	<i>Conyza canadensis</i>
junglerice	<i>Echinochloa colonum</i>
knotweed, prostrate	<i>Polygonum aviculare</i>
lambsquarters, common	<i>Chenopodium album</i>
mallow, little	<i>Malva parviflora</i>
mustard, Indian	<i>Brassica juncea</i>
mustard, wild	<i>Sinapis arvensis</i>
nightshade, black	<i>Solanum nigrum</i>
oat, wild	<i>Avena fatua</i>
panicum, fall	<i>Panicum dichotomiflorum</i>
pepperweed, Virginia	<i>Lepidium virginicum</i>
pigweed	<i>Amaranthus</i> spp.
plantain, slender	<i>Plantago elongata</i>
purslane, common	<i>Portulaca oleracea</i>
radish, wild	<i>Raphanus raphanistrum</i>
ragweed, common	<i>Ambrosia artemisiifolia</i>
shepherdspurse	<i>Capsella bursa-pastoris</i>
smartweed, Pennsylvania	<i>Polygonum pensylvanicum</i>
sowthistle, annual	<i>Sonchus oleraceus</i>
speedwell, purslane	<i>Veronica peregrina</i>
thistle, Russian	<i>Salaola iberica</i>
witchgrass	<i>Panicum capillare</i>

(SAMPLE LABEL - FOR EDUCATIONAL USE ONLY)

Treasure G

Weeds Controlled or Suppressed (Cont.)

Weeds controlled when applied at 150 lb per acre (3.5 lb per 1000 sq ft):

Common Name	Scientific Name
aster, heath	<i>Aster ericoides</i>
bittercress	<i>Cardamine oligosperma</i>
bittercress, hairy	<i>Cardamine hirsuta</i>
carrot, wild	<i>Daucus carota</i>
chickweed, mouseear	<i>Cerastium vulgatum</i>
dandelion	<i>Taraxacum officinale</i>
fireweed	<i>Erechtites hieracifolia</i>
foxtail, giant	<i>Setaria faberi</i>
lettuce, prickly	<i>Lactuca serriola</i>
mallow, dwarf	<i>Malva rotundifolia</i>
marestail	<i>Hippuris vulgaris</i>
morningglory, ivyleaf	<i>Ipomoea hederacea</i>
pennywort	<i>Hydrocotyle</i> spp.
phyllanthus, long-stalk	<i>Phyllanthus tenellus</i>
plantain, bracted	<i>Plantago aristata</i>
plantain, broadleaf	<i>Plantago major</i>
plantain, buckhorn	<i>Plantago lanceolata</i>
pokeweed, common	<i>Phytolacca americana</i>
ryegrass, annual	<i>Lolium multiflorum</i>
sorrell, red	<i>Rumex acetosella</i>
spurge, hyssop	<i>Euphorbia hyssopifolia</i>
spurge, spotted	<i>Euphorbia maculata</i>
sweetclover, yellow	<i>Melilotus officinalis</i>
velvetleaf	<i>Abutilon theophrasti</i>
woodsorrel, yellow	<i>Oxalis stricta</i>

Weeds Controlled or Suppressed (Cont.)

Weeds controlled when applied at 200 lb per acre (4.6 lb per 1000 sq ft):

Common Name	Scientific Name
barley, hare	<i>Hordeum leporinum</i>
bromegrass	<i>Bromus</i> spp.
eveningprimrose	<i>Oenothera</i> spp.
fescue, rattail	<i>Vulpia myuros</i>
goosefoot, nettleleaf	<i>Chenopodium murale</i>
jimsonweed	<i>Datura stramonium</i>
knotweed, silversheath	<i>Polygonum argyrocoleon</i>
medic, black	<i>Medicago lupulina</i>
nettle, burning	<i>Urtica urens</i>
nettle, stinging	<i>Urtica dioica</i>
signalgrass	<i>Brachiaria</i> spp.
sowthistle, spiny	<i>Sonchus asper</i>
spurge, petty	<i>Euphorbia pepus</i>
spurge, prostrate	<i>Euphorbia humistrata</i>
stinkgrass	<i>Eragrostis cilianensis</i>
sunflower	<i>Helianthus</i> spp.
thistle, musk	<i>Carduus nutans</i>
willoweed, panicle	<i>Epilobium paniculatum</i>
woodsorrel, creeping	<i>Oxalis corniculata</i>
bindweed, field	<i>Convolvulus arvensis</i>
dock, curly	<i>Rumex crispus</i>
johnsongrass (seedling)	<i>Sorghum halepense</i>
Milkweed, honeyvine	<i>Ampelamus albidus</i>
morningglory, tall	<i>Ipomoea purpurea</i>
shattercane	<i>Sorghum bicolor</i>

Uses

Ornamental Plantings

Treasure G is recommended as a preemergence treatment for control of certain broadleaf weeds and annual grasses in container grown ornamentals, landscape ornamentals, field grown ornamentals, ground covers/perennials, Christmas trees, non-bearing fruit and nut crops, and non-bearing vineyards. Apply Treasure G anytime prior to germination of target weeds, or immediately after cultivation.

Refer to the General Information section of this label for General Use Precautions and information on application, application rates and weeds controlled.

Special Use Precautions:

To avoid possible injury, do not apply Treasure G to:

- nursery, forest, or Christmas tree: seedling beds, cutting beds, or transplant beds.
- nursery seedbeds or forest or Christmas tree seedling transplant beds.
- unrooted liners or cuttings that have been planted in pots for the first time.

- pots less than four inches wide.
- bedding plants or areas where bedding plants will be planted or transplanted within one year following application.
- groundcovers until they are established and well rooted.

Do not apply Treasure G to newly transplanted ornamentals, nursery stock, Christmas trees, groundcovers, non-bearing fruit and nut trees and non-bearing vineyards until soil or potting media has been settled by packing and irrigation or rainfall and no cracks are present or injury may occur.

Repeat applications at 150 lb per acre and higher should not be made sooner than 60 days after a previous application of Treasure G. Do not apply over 600 lb per acre total of Treasure G within a 12-month period.

Where loss of stand has occurred in field grown ornamentals, use untreated soil as fill around roots when replacing plants or injury may occur.

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Treasure G

Note: Injury on the following plant species has been observed following applications of Treasure G and use is not recommended.

Common Name	Scientific Name
bertram anderson lingwort	<i>Pulmonaria longifolia</i>
bugle	<i>Ajuga</i> spp.
candytuft	<i>Iberis</i> spp.
Carolina rhododendron	<i>Rhododendron carolinianum</i>
dwarf burning bush	<i>Euonymus alatus 'compacta'</i>
foxglove	<i>Digitalis pupurea</i>
hydrangea	<i>Hydrangea</i> spp.
luxuriant bleeding heart	<i>Dicentra luxuriant</i>
mountain sandwort	<i>Arenaria montana</i>
mustard	<i>Brassica</i> spp.
prince of wales juniper	<i>Juniperus horizontalis</i>
purple coneflower	<i>Echinacea pupurea</i>
spurge	<i>Euphorbia</i> spp.
stonecrop	<i>Sedum</i> spp.
summer phlox	<i>Phlox paniculata</i>
white festival baby's breath	<i>Gypsophila paniculata</i>
wine periwinkle	<i>Vinca minor 'Atropurpurea'</i>

Treasure G may be used on the following established plant species (Note: Limitations on recommended treatment methods C = Container Grown; F = Field Grown):

Trees*

Scientific Name	Common Name	
<i>Abies balsamea</i>	fir, balsam	C, F
<i>Abutilon hybridum</i>	albus-flowering maple	C, F
<i>Acer ginnala</i>	flame maple	C, F
<i>Acer rubrum</i>	red maple	C, F
<i>Acer saccharinum</i>	silver maple	C, F
<i>Betula nigra</i>	birch, river	F
<i>Betula papyrifera</i>	paper birch	F
<i>Brachychiton populneus</i>	bottle tree	F
<i>Bucida buceras</i>	black olive	F
<i>Cercis canadensis</i>	redbud	C, F
<i>Cornus florida</i>	cloud nine dogwood	F
<i>Crataegus viridis</i>	green hawthorn	F
<i>Cryptomeria japonica</i>	cryptomeria, Japanese	F
<i>Cupaniopsis</i>	carrot wood	C, F
<i>Dicksonia antartica</i>	Tasmanian tree fern	C, F
<i>Elaeagnus angustifolia</i>	Russian olive	F
<i>Elaeagnus x 'Gilt edge'</i>	gilt edge silverberry	C, F
<i>Eucalyptus camaldulensis</i>	red gum eucalyptus	F
	eucalyptus, mealy	C, F
<i>Eucalyptus cinerea</i>	silver dollar eucalyptus	C, F
<i>Eucalyptus microtheca</i>	eucalyptus, red ironbark	F
<i>Eucalyptus sideroxylon</i>	ficus	F

* **Recommended Treatment Method:**

C = Container Grown

F = Field Grown

Shrubs*

Scientific Name	Common Name	
<i>Acer ginnala</i>	amur maple	C, F
<i>Acer palmatum</i>	coral bark Japanese	C, F
<i>Berberis gladwynensis</i>	william penn barberry	C, F
<i>Berberis mentorensis</i>	mentor barberry	C, F
<i>Berberis thunbergii</i>	aurea-golden Japanese barberry	F
<i>Buxus x 'Green velvet'</i>	green velvet boxwood	C, F
<i>Buxus microphylla japonica</i>	boxwood, Japanese	C, F
<i>Buxus microphylla Koreana</i>	Korean boxwood	F
<i>Buxus sempervirens</i>	boxwood, common	C, F
<i>Callistemon citrinus</i>	bottlebrush, lemon	F
<i>Callistemon viminalis</i>	weeping bottlebrush	C, F
<i>Calluna vulgaris</i>	spring torch Scotch heather	C, F
<i>Camellia japonica</i>	camellia	C, F
<i>Caryopteris x clandonen</i>	dark knight bluebeard	C, F
<i>Cassia artemisioides</i>	cassia, feathery	C, F
<i>Ceanothus</i> spp.	wild liliac	F
<i>Cephalotaxus drupacae</i>	plum yew	C, F
<i>Chamaecyparis pisifera</i>	baileyi-dogwood	F
	flaviramea-dogwood	F
<i>Cotoneaster adpressus</i>	praecox-early cotoneaster	C, F
<i>Cotoneaster apiculatus</i>	cotoneaster, cranberry	C, F
<i>Cotoneaster congestus</i>	cotoneaster, Pyrenees	C, F
<i>Cotoneaster dammeri</i>	cotoneaster, bearberry	C, F
<i>Cotoneaster himalayan</i>	Himalayan cotoneaster	C, F
<i>Erica vagans</i>	cornish heather	C, F
<i>Erica x darleyensa</i>	Mediterranean pink heather	C, F
<i>Eugenia myrtifolia</i>	dwarf brush cherry	C, F
<i>Euonymus x 'Aureo variegatus'</i>	gold spot euonymus	C, F
<i>Euonymus x 'Chollipo'</i>	chollipo euonymus	C, F
<i>Euonymus fortunei</i>	canadale gold euonymus	C, F
	emerald'n gold euonymus	F
	sunspot euonymus	C, F
<i>Euonymus japonica</i>	silver king euonymus	F
	variegated evergreen euonymus	C, F
<i>Euronymus kiatschovica</i>	spreading euonymus	C, F
<i>Euronymus vegetus</i>	bigleaf wintercreeper	C, F

***This is an educational label and does not contain a full list for any plant specie.**

(SAMPLE LABEL - FOR EDUCATIONAL USE ONLY)

Treasure G

Recommended Treatment Method:

C = Container Grown

F = Field Grown

Non-Bearing Fruit and Nut Trees

Non-Bearing Vineyards¹

Groundcovers/Perennials*

Scientific Name	Common Name	C,F
<i>Achillea millefolium</i>	common yarrow	C, F
<i>Agapanthus africanus</i>	lily of the Nile	C, F
<i>Agapanthus "Peter Pan"</i>		C, F
<i>Alstroemeria aurea</i>	Peruvian lily	C, F
<i>Ammophila breviligulata</i>	beechgrass	C, F
<i>Antirrhinum majus</i>	snapdragon	C, F
<i>Arctotheca calendula</i>	cape weed	F
<i>Argyranthemum frutescens</i>	Paris daisy	C, F
<i>Artemisia schmidtiana</i>	angels' hair	C, F
<i>Carpobrotus edulis</i>	ice plant, largeleaf	F
<i>Catharanthus roseus</i>	Madagascar periwinkle	C, F
<i>Cerastium tomentosum</i>	snow in the summer	C, F
<i>Chrysanthemum sp.</i>	blue bell clematis	C, F
<i>Clematis integrifolia caerulea</i>	kafir lily	
	coreopsis, threadleaf	C, F
<i>Clivia miniata</i>	pampas grass	C, F
<i>Cyperus albostrigatus</i>	dwarf umbrella grass	C, F
<i>Hesperaloe parviflora</i>	red yucca	C,F
<i>Heuchera micrantha</i>	coral bells	C,F
<i>Hippeastrum hybrid</i>	amaryllis	C,F
<i>Hosta 'Francee'</i>	francee plantain lily	C,F
<i>Hosta lancifolia</i>	albo-marginata hosta	C,F
<i>Hosta 'Patriot'</i>	patriot plantain lily	C,F
<i>Hymenoxys acaulis</i>	angelita daisy	C,F

Common Name	C,F
apple	F
apricot	F
blackberry	F
blueberry	F
boysenberry	F
cherry, sour	F
cherry, sweet	F
currant	F
elderberry	F
gooseberry	F
grape, American	F
grape, European	F
loganberry	F
peach	F
pear	F
plum	F
raspberry	F
walnut, black	F

***This is an educational label and does not contain a full list.**

¹Non-bearing fruit and nut trees and non-bearing vineyards are defined as plants which will not bear fruit for at least one year after treatment.

Shadehouse Areas

Treasure G may be applied in open shadehouse-type structures where the natural flow of air is unimpeded. Do not apply in enclosed greenhouses or in enclosed shadehouse-type structures. Do not apply within three weeks prior to enclosing greenhouse or poly-type structures.

Non-Cropland

Treasure G is recommended as a preemergence treatment for control of certain broadleaf weeds and annual grasses on non-cropland areas such as industrial sites, utility substations, highway guardrails, sign posts, delineators, etc. Apply Treasure G anytime prior to germination of target weeds. Areas to be treated should be free of established weeds or existing weeds should be controlled with postemergence herbicides.

Refer to the General Information section of this label for General Use Precautions and information on Application, Application Rates, and Weeds Controlled.