Ohio Pesticide Applicator Study Guide

Fruit & Vegetable Crops
Reference Publications

Ohio Vegetable Production Guide (OSU Extension Bulletin 672)
Midwest Small Fruit Pest Management Handbook (OSU Extension Bulletin 861)
Midwest Tree Fruit Handbook (OSU Extension Bulletin 506A)

Pesticide Safety Education Program
Ohio State University Extension

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PESTICIDE SAFETY EDUCATION PROGRAM

Ohio Pesticide Applicator
Fruit and Vegetable Crops Study Guide

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Fruit & Vegetable Crops Study Guide

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Overview of Fruit and Vegetable Crops Study 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 exams required for certification in fruit and vegetable categories. (Private Applicator Category 3).

The reader should be familiar with all the topics in the outline on the following pages. The sample questions presented in this manual will help the reader practice and apply his/her general understanding of fruit and vegetable crop pest problems, approaches to control, and general information needed in order to apply and use pesticides safely.

How to Use this Study Guide

The Ohio Pesticide Applicator Study Guide for Fruit and Vegetable Crops (Bulletin 821-3) includes questions to help guide you through an overview of general fruit and vegetable 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 label found at the back of the study guide.

Preparing for the Exam

An emphasis of the Private Applicator Study Guide for Fruit and Vegetable Crops is reading and understanding the label. Applicators should understand the importance of the label as it relates to all aspects of pesticide application. A brief overview of the important concepts and issues addressed on the exam is presented in this study guide.

Other bulletins are recommended to help you manage pests and understand pesticide use on your specific crops. Suggested reference materials are listed inside the front cover of the study guide.
Fruit and Vegetable Crops Exam Outline

To help applicators for the Fruit and Vegetable Crops Exam, the following is a brief outline of the important concepts of pesticide applications for this category. Pesticide applicators will need to have a general pesticide knowledge and be familiar with the major pests of fruits and vegetables in Ohio. A brief overview of the primary crops and issues is presented here. Each of these topics is covered in the overview and practice questions in this study guide.

Ohio Fruit and Vegetable Crops
(rank in order of emphasis on exam)

1. Solanaceous vegetables (tomato/pepper/potato)
2. Sweet corn
3. Cucurbits
4. Apples
5. Strawberries

Pest Problems
(rank in order of emphasis on exam)

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

General Pesticide Topics for Fruits and Vegetables

Integrated Pest Management (IPM) Concepts and Tools
Applicators should be able to:
- Define Integrated Pest Management (IPM)
- Identify how methods of IPM can be used in fruit and vegetable pest management
- Indicate cultural controls that improve plant health and reduce pesticide use
- State strategies to protect natural enemies and beneficials
Using IPM to Determine Timing of Spray Applications
Applicators should be able to:

- Define economic and action thresholds
- Compare field scouting and trapping as pest monitoring methods
- Indicate how weather monitoring of degree days, rainfall and other seasonal weather conditions could predict pest problems and aid in scheduling spray applications
- Explain how applicators could be alerted to potential pest problems based on specific weather conditions
- Summarize how spray schedules are a combination of monitoring weather conditions, identifying plant growth stage, and pest monitoring

Pesticide Resistance Management
Applicators should be able to:

- Distinguish how resistance develops from continued use of a pesticide with the same mode of action
- Select insecticides based on Insecticide Resistance Action Committee (IRAC) group to manage resistance
- Select fungicides based on Fungicide Resistance Action Committee (FRAC) group to manage resistance

Environmental Concerns
Applicators should be able to:

- Indicate management practices to reduce exposure to endangered or non-target species like honey bees
- Determine if label contains a bee advisory and relate what steps need to be taken before application
- Explain soil carryover issues

Application and Equipment
Applicators should be able to:

- Summarize methods to clean-out spray tanks to prevent residues
- Contrast band and broadcast applications
- Calculate application area and tank fill for banding applications
- Describe application situations when leaf surface coverage is critical
- Identify different equipment and methods used for directed sprays such as drop nozzles, hoods, shields, two-directional nozzles
- Identify personal protection equipment (PPE) precautions needed with airblast sprayers
- Calculate tree-row volume to determine application areas for orchards
Reading pesticide labels
Applicators should be able to read a pesticide label to:

- Identify setbacks/buffers for different application situations
- Compare Restricted Entry Interval (REI) for mechanical care of crops versus hand-labor care
- Determine Pre-Harvest Interval (PHI) and harvest restrictions
- List crops on which the label indicates the pesticide product can legally be used
- Explain legal consequences of using the pesticide product on a crop not listed on the pesticide's label
- Cite maximum and minimum use rates for specific crops
- Identify Personal Protective Equipment (PPE) needed for applicators, handlers and early-entry workers

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
- Explain WPS compliance beyond the label
- Classify the role of a worker and a 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 Ohio Fruit and Vegetable Crops

Insect Group Management
Applicators should be able to identify the characteristic signs and vulnerable life stage and describe the severity of damage on fruits and vegetables from these common insect/mite groups:

**Chewing Insects:**
- Caterpillars
- Beetles

**Sucking Insects:**
- Aphids
- Leafhoppers
- Mites
- Scale

Applicators should be able to:
- Differentiate control of general pests that affect various crops to specialized pests that target specific crops
- Relate usage of pheromones for insect pest management
- Compare systemic and contact movement of insecticides
- Contrast systemic movement of soil versus foliar applied insecticides
- Identify the use of seed treatments for insect management

Weed Management
Applicators should be able to:
- Differentiate between grass, sedge and broadleaf weeds
- Distinguish control strategies for annual vs. perennial weeds
- Contrast winter and summer annual control
- Define preemergence and postemergence
- Indicate cultural controls for weed management
- Identify some common weeds:
  1. Quackgrass
  2. Dandelion
  3. Chickweed
  4. Canada Thistle
  5. Shepherdspurse
  6. Henbit
**Disease Management**  
Applicators should be able to:

- Show the disease triangle and explain the three factors affecting disease development
- Relate method of disease control to fruit and vegetable situations:
  - Resistant varieties
  - Avoidance
  - Sanitation
  - Fungicides
  - Not everything is treatable

From these disease groups, applicators should be able to identify common diseases, give examples of damage, and relate general control measures:

- Mildews (powdery and downy)
- Root rots
- Fungal leaf blights
- Rusts
- Bacterial
- Virus

**Nuisance Pest Management**  
Applicators should be able to:

- Give examples of control for nuisance pests such as deer and birds
- Identify methods to reduce rodent populations

*Note: This summary is meant to guide users to key areas to study for the fruit and vegetable exam. Most knowledge areas on the exam were addressed at the time of printing. However, practices, products, and therefore versions of the exam change and may not be completely reflected in this manual.*
Overview of Ohio Fruit and Vegetable Crops
Private Applicator Category 3

Following are some concepts of pest management in fruit and vegetable operations in Ohio. More specific and technical information for the applicator to review for exam preparation is covered in the study test questions in this study guide.

Private Applicator Category 3 covers pesticide application to fruit and vegetable crops. The exam focuses on the broad pest management concepts involved with fruit and vegetable 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 fruit and vegetable 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.

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, crop rotation, destroying crop residues, water management, trellis training systems, seeding rate and row spacing. Also, using resistant varieties, resistant host plant and promoting plant health are included in cultural controls. These controls require an understanding of the pest and crop 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.

Biological - use of natural enemies to control or reduce a pest population such as predators, parasitoids and pathogens.
- Predators are other organisms that feed on the pest. Examples are a lady beetle that feeds on aphids or a minute-pirate bug that feeds on corn earworm eggs.
- Parasitoids are generally an insect that develops and feeds inside another insect. The adult lays an egg in or on a host insect, the egg hatches and the larvae feeds on the host insect. Examples are tachinid flies that lay eggs in or on beetles and caterpillars, or braconid wasps that feed on caterpillars, beetles and aphids.
- Pathogens are disease-causing bacteria, viruses or fungi that infect and kill the pest. Some of these pathogens are naturally occurring if the environmental conditions are ideal. Examples are bacillus thuringiensis (BT), which controls caterpillars and some beetle larvae, and trichoderma, which controls plant diseases such as pythium and rhizoctonia.

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 & Trapping
Field scouting and trapping are 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

Field scouting also requires inspection of the plants to look for the presence of insect or disease pests. The scout needs to inspect all parts of the plant including underneath the leaves near the top, middle, and lower parts of the plants.

Trapping can be used to detect the presence of insect pests, determine the level of the pest population, and if the pest population is increasing or decreasing. There are several different types of traps and deciding which trap to use is based on the pest that is being scouted. Pheremone traps are typically used to lure the males of specific pest species. The shape of the trap, as well as the pheremone used, will help attract the specific pest.

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.

Weather Monitoring
Weather conditions can influence the type and severity of pest problems with weeds, insects and disease. Weather data and models can be used as a predictor of pest problems before they become an issue in the crop. Temperature, humidity, rainfall and drought can be tracked and used by growers to determine the optimal spray times based on the crop’s growth stage in relation to the development of the pest population.

For example, long-term temperature trends influence the rate of insect development. Each insect has a temperature range that promotes growth and if the temperature is below the insect’s comfort level, development will be slowed or even stopped. This same concept is that if the temperature is at or above the comfort level the insect may develop at a faster rate resulting in earlier crop damage.

Degree-days are one method of weather prediction that used to estimate development time for some insects and weeds. A formula is used with the number of days above a certain temperature in combination with the range of temperatures on those days to predict the growth of weeds and the time when the insect will begin damaging a crop. This degree-day information can be accessed in real time through OSU Extension websites or newsletters to help growers determine the optimal time for spray applications when the most control will be achieved.

Other weather-prediction models are available for growers to access regarding moisture levels and humidity that would predict disease formation. For example, collecting weather information such as temperature, leaf wetness, and rainfall during the spring will help predict that optimum time for apple growers to make preventative sprays for apple scab and fireblight before the disease develops.
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. Worldwide-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:

- Avoid repeated use of fungicides/insecticides from the same chemical group
- Alternate with products from other FRAC or IRAC codes
- Integrate other control methods (chemical, cultural, biological) into control programs
Fruit and Vegetable General Information

Integrated Pest Management (IPM) Concepts and Tools

1. 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

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

3. Cultural controls such as proper fertilization, drainage and choosing resistant varieties 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

4. Biological controls available to growers are:
   a. Parasitoids
   b. Predators
   c. Pathogens
   d. All of the above
Fruit and Vegetable General Information - Answers

Integrated Pest Management (IPM) Concepts and Tools

1. 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.

2. 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.

3. 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.

4. Correct answer: D
   Explanation: A parasitoid is an insect that attaches to a single host, usually a soft-bodied insect, and slowly consumes the body of the host. A predator is an insect that feeds on other insects that are smaller, slower moving or immobile. Beneficial pathogens are bacteria, fungi, viruses and nematodes that cause pest insects to become sick and die. They are not the same pathogens that cause disease in plants.
5. When using natural enemies, growers should **NOT**:
   a. Introduce them at regular intervals
   b. Use them as a rescue treatment
   c. Use them on crops that have only one or two major pests
   d. Introduce them before a pest population becomes too high

6. To achieve leaf coverage for a foliar fungicide application, you should:
   a. Use higher pressure than for herbicides
   b. Choose nozzles to create small droplets
   c. Use sufficient gallonage
   d. All of the above

7. Cleaning spray tanks between applications is important to:
   a. Reduce possible cross contamination
   b. Increase adjuvant activity
   c. Moderate surfactants
   d. None of the above

8. Lady beetle is a biological control that is a:
   a. Parasitoid
   b. Predator
   c. Pathogen
   d. None of the above

9. Braconid wasp is a biological control that is a:
   a. Parasitoid
   b. Predator
   c. Pathogen
   d. None of the above

**Using IPM to Determine Timing of Spray Applications**

10. What term is used in IPM to indicate the level at which pests MUST be controlled?
    a. Insect level
    b. Disease severity
    c. Action threshold
    d. Pest number
5. **Correct answer: B**
Explanation: Biological controls, like natural enemies, are not rescue treatments which means they need to be introduced before pest populations are too high to manage. Natural enemies need to be introduced on a regular basis. Biological controls are usually most successful on crops that are attacked by only one or two major pests.

6. **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.

7. **Correct answer: A**
Explanation: After a pesticide application, there may be residues (leftover pesticide) in the tank. These residues could mix with the next application and cause crop damage if the tank is not cleaned. The residue could also be illegal if the next crop you spray is not on the pesticide label. Often, spray tanks can be cleaned with water, detergent and ammonia, but check manufacturer or label recommendations. Choose a cleanup area where discharged cleaning water will not contaminate ground water, surface water or crops. Discharge water should not form puddles that are accessible to children, livestock, pets or wildlife.

8. **Correct answer: B**
Explanation: A predator is an insect that feeds on other insects. Lady beetles are usually found on leaves feeding on aphids and insect eggs. Predators are usually larger than their prey and commonly attack pests that are slow moving, such as aphids and spider mites, or pests that are immobile, such as scales and the egg stage of caterpillars and other pests.

9. **Correct answer: A**
Explanation: A parasitoid is an insect that attaches to a single host (insect) and slowly consumes the body of the host. The host does not die until the parasitoid completes its development. Parasitoids commonly attack soft-bodied insects such as caterpillars, or eggs, or pupae.

**Using IPM to Determine Timing of Spray Application**

10. **Correct answer: C**
Explanation: Pest action thresholds may be based on aesthetic, health or exonomic consideration. The threshold is set where the potential damage from the pest would exceed the consideration. The threshold is set where the potential damage from the pest would exceed the ability or cost to control the pest. Economic thresholds are constantly changing and vary with crop varieties, between fields, and crop growth stages. Exonomic thresholds are a function of crop value and cost to control. Therefore, a high value crop will have a lower economic threshold.
11. To be effective for busy growers, field scouting should be done:
   a. Once in a growing season
   b. Only when time allows
   c. Numerous times on a regular basis
   d. Every day of the growing season

12. Field scouting for disease in a vegetable field should include:
   a. Plant inspection
   b. Pheromone traps
   c. Black lights
   d. No scouting is needed
   e. 

13. Insect traps are most commonly used to monitor for insects in what stage of their life cycle?
   a. Egg
   b. Larva
   c. Pupa
   d. Adult

14. In the spring when fruit trees are beginning to bud, what weather conditions could influence pest populations in fruit trees?
   a. Temperatures
   b. Rainfalls
   c. Dews
   d. All of the above

15. Degree-days are used in monitoring insect pests:
   a. Growth rate
   b. Population levels
   c. Damage potential
   d. All of the above
11. **Correct answer: C**  
Explanation: Field scouting needs to be done on a regular basis so growers can respond to the pest problem when an action threshold has been reached. While daily scouting would be ideal, it may be unrealistic for many growers. However, it's important that scouting be done regularly so pest populations can be monitored. Records are an important part of the field scouting process to help growers monitor the plants for not only pest presence, but if the populations are growing or decreasing.

12. **Correct answer: A**  
Explanation: Diseases scouting should be part of a field monitoring program. Plants need to be inspected, including the top and underside of leaves and stems. The plant inspection also needs to be done on the top, middle, and bottom of the plant and should include plants in various areas of the field to provide a more reliable assessment of the field conditions. Weather conditions should also be monitored as the environmental conditions such as temperature and moisture will create favorable conditions for some diseases to develop. Pheromone traps and black lights are used for monitoring for insect pests.

13. **Correct answer: D**  
Explanation: Insect trapping is done to monitor the adult stage when the insects are the most mobile. The egg and pupa stages are when the insects are immobile and most larvae (such as caterpillars) remain on the plant to consume food in preparation for the pupa stage. Because of this other scouting methods such as plant inspection and new sweeping may be needed to accurately evaluate pest populations.

14. **Correct answer: D**  
Explanation: Fruit trees and other plants are vulnerable to pests at different times of their life stages. For example, warm temperatures with heavy dews in the spring can accelerate the formation of apple scab, a disease that affects apple trees. The acceleration could affect the tree at the vulnerable time during fruit formation. Weather monitoring will help growers anticipate potential pest problems, so spray applications can be made at the most optimal time for the crop.

15. **Correct answer: D**  
Explanation: Each insect species has a specified temperature range that is ideal for its growth, feeding and development. If the temperature is lower than this range, the insect's development will be slowed or stopped. If the temperature is higher or within this range for extended periods of time, the insect's development will be accelerated. Degree-days is a temperature model that has been developed to predict when insect pests will cause damage to specific crops. The degree-day model looks at temperature over an extended period of time in relation to a specific insect's needed temperature range to hatch, pupate and emerge as an adult. By using these accumulated degree-days, growers can predict when a specific insect will appear in a specific crop. This alerts growers to the need to scout for the insect and take necessary steps if a threshold is reached.
Pesticide Resistance Management

16. How does pesticide resistance develop?
   a. From a lack of proper crop variety selection
   b. From repeated applications of the same pesticide
   c. From repeated applications of pesticides with a common mode of action
   d. Both b & c

17. Which insect would be less prone to pesticide resistance?
   a. A chewing insect
   b. A sucking insect
   c. An insect with a short life cycle
   d. An insect with a long life cycle

18. When using an insecticide in group 4A on apples the grower should:
   a. Use group 4A for the rest of the season
   b. Keep the same product for the apples to maintain consistency
   c. Using anything but group 4A for the rest of the season
   d. Read the label and follow directions on alternating with an insecticide in a different group.

19. What is “IRAC” code on an insecticide label?
   a. The toxicity of the active ingredient
   b. The location of the manufacturing plant
   c. A mode of action grouping
   d. DOT shipping signal word

Environmental Concerns

20. The pesticide formulation with the lowest exposure for bees is:
   a. Granular
   b. Wettable powders
   c. Dusts
   d. Emulsifiable concentrates

21. During what time of day should spraying be done when there is a honey-bee advisory on the label?
   a. During the middle of the afternoon
   b. In early morning or late day
   c. Around noon
   d. Just before a rain
Pesticide Resistance Management

16. 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 a single pesticide is used, there is a chance that some of the pests in the population may not be susceptible and 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 which causes resistance.

17. 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. Resistant pesticide application can develop in both chewing and sucking insects.

18. Correct answer: D
The IRAC or FRAC numbers, such as group 4A, will appear on the front of the pesticide label. This label will give further directions on the best way to alternate the product with 4A with other groups to prevent pest resistance.

19. Correct answer: C
Explanation: The IRAC (Insecticide Resistance Action Committee) and the FRAC (Fungicide Resistance Action Committee) code represents the mode of action of the insecticide/fungicide chemistry. Pesticides listed with the same code have a similar mode of action. Alternating products with different codes will help prevent resistance because the mode of action is changed. Codes can normally be found on the front page of the product label.

Environmental Concerns

20. Correct answer: A
Explanation: Different formulations of the same insecticide can vary in their toxicity to bees. Granular formulations have the least exposure because of the large particle size, and because they are soil applied. Emulsifiable concentrates are generally less toxic than wettable powders. Dusts are the most hazardous because the particles can be taken back to the hive and affect the entire hive. Always read the label for bee advisories or any other environmental hazards.

21. Correct answer: B
Explanation: Labels may advise to not spray crops in bloom or not spray when weeds or other plants around/or in the treatment site are in bloom. Honey bees are least active early in the morning or late in the evening, so pesticides with a bee advisory should be sprayed during those times.
22. When using a pesticide with a bee advisory on the label, Ohio pesticide law says applicator must:
   a. Spray when crops are flowering
   b. Choose only dust formulation
   c. Using lower amounts of water as the carrier
   d. Contact beekeepers with a registered apiary within 1/2 mile of application site 24 hours in advance of spraying

23. 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

Application and Equipment
24. Cleaning spray tanks between applications is important to:
   a. Reduce possible cross contamination
   b. Increase adjuvant activity
   c. Moderate surfactants
   d. None of the above

25. 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:
   a. The same rate
   b. Double the intended rate
   c. Half the intended rate
   d. None of the above

26. To achieve leaf coverage for a foliar fungicide application, you should:
   a. Use higher pressure than for herbicides
   b. Choose nozzles to create small droplets
   c. Use sufficient gallonage
   d. All of the above
22. **Correct answer: D**  
Explanation: According to Ohio law, if a pesticide is toxic to bees, registered apiaries within 1/2 mile must be notified 24 hours in advance of the application. These pesticides will have bees listed in the environmental hazards section of the label.

23. **Correct answer: D**  
Explanation: Crops can be damaged from pesticide residues remaining in the soil from previous agronomic, vegetable or fruit crops. This soil residue is called carryover, and a few herbicides can damage vegetable crops 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. Be aware of this especially when planting more than one vegetable crop in a field in a season.

**Application and Equipment**

24. **Correct answer: A**  
Explanation: After a pesticide application, there may be residues (leftover pesticide) in the tank. These residues could mix with the next application and cause crop damage if the tank is not cleaned. The residue could also be illegal if the next crop you spray is not on the pesticide label. Often, spray tanks can be cleaned with water, detergent, and ammonia, but check manufacturer or label recommendations. Choose a cleanup area where discharged cleaning water will not contaminate ground water, surface water, or crops. Discharge water should not form puddles that are accessible to children, livestock, pets, or wildlife.

25. **Correct answer: B**  
Explanation: Calibration is the process of measuring and adjusting the amount a sprayer is applying to the target area. Speed is one of the factors in calibration. When the tractor speed is reduced by 50 percent, the rate of application is doubled because it takes twice as long to cover the same area.

26. **Correct answer: D**  
Explanation: Adequate pressure and spray volume or gallonage is needed to penetrate the crop canopy 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.
Pesticide Labels

Draw a line to match the following label definitions with the correct term:
Note: All questions on the exam will be multiple choice.

27. Reduces worker exposure to pesticides
   a. Phytotoxicity

28. Crop damage from pesticide application
   b. REI (Restricted Entry Interval)

29. Amount of time required between last pesticide application and harvest
   c. PHI (Preharvest Interval)

For questions 22-29, please refer to the Remote Channel label beginning on page 46.

30. When using this fungicide on raspberries to control spur blight, what is the restricted entry interval (REI)? (See label in back of study guide.)
   a. 0 hours
   b. 8 hours
   c. 12 hours
   d. 24 hours

31. When using Remote Channel fungicide on tomatoes to control Septoria leaf spot, what is the preharvest interval (PHI)? (See label in back of study guide.)
   a. 0 days
   b. 5 days
   c. 7 days
   d. 14 days

32. A grower has a 15 acre field of cucumbers to be sprayed to control downy mildew. How much Remote Channel fungicide should be used to spray this field? (See label in back of study guide.)
   a. 80 oz.
   b. 160 oz.
   c. 240 oz.
   d. 320 oz.
Pesticide Labels

27. Correct answer: B
Explanation: Restricted Entry Intervals (REI) are set by the EPA for each product. To ignore pesticide restricted entry intervals is illegal. REI’s allow enough time for residues on plants to be reduced and therefore reduce exposure hazards to workers in the field. The REI will be listed in the Agricultural Use Requirement section for crop uses or under the specific crop site on the label. A label may also have a separate REI for areas that are not for agricultural uses, such as home lawns or roadside and utility rights of way.

28. Correct answer: A
Explanation: Pesticide phytotoxicity is the injury to plants caused by exposure to a pesticide application. Injury can be dead or scorched leaf tips, misshapen fruit, leaves or plants, stunted plant growth, off color plants, or even death of a plant.

29. Correct answer: C
Explanation: Preharvest intervals are the minimum number of days that must pass between the last application of a pesticide and the harvest of crops. Intervals are set by the EPA to allow time for the pesticide to break down on crops to assure food safety. The preharvest interval is listed by individual crop on the pesticide label. Crops with illegal residues can be condemned or destroyed and growers can be fined.

30. Correct answer: D
Explanation: The Remote Channel label states, “Do not enter the treated area within 24 hours of the most recent application,” which is listed under the chart for the berry group on page 54.

31. Correct answer: A
Explanation: The Remote Channel label chart for the fruiting vegetable group lists the minimum time from application to harvest is 0 days. The chart is on page 58.

32. Correct answer: B
Explanation: Rate is 8-12 oz. per acre on the label.

Rate #1: \( \frac{8 \text{ oz}}{\text{acre}} \times 15 \text{ acres} = 120 \text{ oz.} \)  
Rate #2: \( \frac{12 \text{ oz}}{\text{acre}} \times 15 \text{ acres} = 180 \text{ oz.} \)  
160 oz. is in the range of rate needed.
33. Regarding the above cucumber field, if the grower needs to make additional applications, what is the maximum total rate per acre of Remote Channel fungicide that can be used on the field for the season? *(See label in back of study guide.)*
   a. 24 oz.
   b. 48 oz.
   c. 64 oz.
   d. 72 oz.

34. Remote Channel fungicide belongs to what resistance management group based on the mode of action. *(See label in back of study guide.)*
   a. 7
   b. 11
   c. 15
   d. 19

35. What formulation is Remote Channel fungicide? *(See label in back of study guide.)*
   a. Flowable
   b. Wettable powder
   c. Emulsifiable concentrate
   d. Water dispersible granule

36. A grower wishes to apply a 20-inch band spray to a tomato field with Remote Channel fungicide for late blight. The tomatoes are on rows with the centers spaced 60 inches apart. The grower decides to use the lowest rate. How much fungicide does he need to add to the tank for 5 acres? *(See label in back of study guide.)*
   a. 12.8 oz.
   b. 13.3 oz.
   c. 38.4 oz.
   d. 59.6 oz.

### WPS - Worker Protection Standard

37. 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.
   a. Pesticide safety training
   b. Decontamination sites
   c. Central information posting
   d. All of the above
33. Correct answer: C  
Explanation: According to the crop specific restrictions and limitations table, the maximum amount of Remote Channel that may be applied per acre to cucumbers in a season is 64 oz. This is found on the chart on page 56.

34. Correct answer: B  
Explanation: Remote Channel is FRAC Group 11 mode of action. To manage fungicide resistance, you should alternate with a product with a different FRAC group number. The group number is at the top of the first page of the label (see page 48). More information is given in the label on page 50.

35. Correct answer: D  
Explanation: This formulation is a dry water dispersible granule (EG) that becomes flowable when added to water. It is easy to handle. The EG is indicated under the brand name at the top of the first page of the label (see page 48).

36. Correct answer: B  
Explanation: The area that will be sprayed needs to be determined.

\[
\text{band width} \times \text{field size} = \text{area to be sprayed} \\
\text{row spacing}
\]

\[
\begin{align*}
\text{20 inches} \times 5 \text{ acres} &= 1.67 \text{ acres} \\
\text{60 inches}
\end{align*}
\]

Then determine the amount of product for the application:

\[
\text{area to be sprayed} \times \text{rate per acre} = \text{amount of product needed}
\]

\[
\begin{align*}
1.67 \text{ acres} \times 8 \text{ oz. per acre} &= 13.3 \text{ oz.} \\
\end{align*}
\]

WPS - Worker Protection Standard

37. Correct answer: D  
Explanation: A farm with one or more employees who perform tasks related to the cultivation and harvesting of plants 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.
38. Under WPS, a worker is:
   a. A certified crop advisor
   b. An employee who works in the field
   c. A seed sales representative
   d. None of the above

39. WPS requires employers to give oral warnings to workers when:
   a. The worker may be within 1/4 of a mile of the treated area
   b. The pesticide application is being done
   c. The REI is still in effect
   d. All of the above

40. Under WPS, a pesticide handler or worker is involved with:
   a. Mixing, loading, transferring or applying pesticides
   b. Handling opened containers of pesticides
   c. Cleaning, handling, adjusting or repairing the parts of mixing, loading or application equipment that may contain pesticide residues
   d. All of the above

41. During a restricted-entry interval (REI), a pesticide handler may enter a treated field to perform a handling task:
   a. Any time after a pesticide has been used
   b. If he or she is trained and wearing personal protective equipment (PPE)
   c. When the smell is gone
   d. After spray has dried

42. What additional PPE item is required for early-entry to a treated area compared to handler requirements? *(See label in back of study guide)*
   a. Gloves
   b. Respirator
   c. Coveralls
   d. Nothing additional is required
38. **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, weeding or watering relating to the production of agricultural plants on a farm, forest, nursery or greenhouse.

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

40. **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

41. **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.

42. **Correct answer: C**
Explanation: There are two places on the Remote Channel label that have required PPE. On the first page, the PPE indicates that applicators and handlers must wear:
- Long-sleeved shirt and long pants
- Chemical-resistant gloves made of any waterproof materials (such as Nitrile, Butyl, Neoprene, and/or Barrier Laminate)

In the Agricultural Use Requirements box in the Direction of Use, the label lists PPE required for early entry to treated areas that is permitted under WPS:
- Coveralls
- Chemical-resistant gloves made of any waterproof material (such as Nitrile, Butyl, Neoprene, and/or Barrier Laminate)
- Shoes plus socks

Coveralls are required for early entry to treated areas, but not for handlers making the application.
## Fruit and Vegetable Insect Groups & Management

For Questions 1-6, complete the table by writing the letter of each insect next to the correct picture and description. *Note: All questions on the exam will be multiple choice.*

### Possible Answers:
- a. Aphid
- b. Leafhopper
- c. Mite
- d. Beetle

1. ________

Name this pictured insect that sucks plant juices and secretes a sticky substance called “honeydew.” They may transmit viruses to the plant and are usually wingless.

![Image of Aphid]

2. ________

This insect is more of a problem in hot, dry weather and has a short life cycle with many generations per season.

![Image of Leafhopper]

3. ________

This insect is able to increase in numbers in a very short time, but is generally easily killed with insecticides. They suck plant juices from the underside of leaves causing tip burn.

![Image of Mite]

4. ________

This hard-shell insect will eat small holes in plant leaves, which can injure small plants.

![Image of Beetle]
Fruit and Vegetable Insect Groups & Management - Answers

1. **Correct answer: A**
   Explanation: Aphids are soft-bodied insects that vary in color depending on the plant species they are feeding on. They can transmit viruses from one plant to another by the way they directly penetrate the plant tissue. While aphids lay eggs, during the summer months the adults will have live births, which allows the babies to mature more quickly and increase the population during the infestation.

2. **Correct answer: C**
   Explanation: Mites occur on the bottom side of leaves and suck plant juices, creating a bronze or yellow, speckled appearance. Some problem mites called spider mites produce webbing. There are also beneficial predator mites. When mites are killed, other damaging mites populations can build up. Mites are very tiny sucking insects that thrive in hot, dry weather when plants are stressed. They have a very short life cycle and produce many generations per season. This increases their numbers rapidly. The multiple generations in one season allows for possible pesticide resistance.

3. **Correct answer: B**
   Explanation: Leafhoppers feed on plant sap with piercing-sucking mouth parts. They may transmit plant viruses and bacteria. They are characteristically wedge-shaped and jump (hop) or fly off readily. The young, called nymphs, resemble the adults, but do not have wings. Because the nymphs can’t fly, control is most effective at this life stage.

4. **Correct answer: D**
   Explanation: There are many types of beetles. Sometimes the adult does damage and other times the larvae or worm-like stage is most damaging to the crop. Plant inspection or scouting is important to detect pest presence to increase the effectiveness of control.
Possible Answers:
  a. Aphid
  b. Caterpillar
  c. Mite
  d. Scale

5. ___________

These insects vary dramatically in their appearance and have crawler stages and immobile stages where they are permanently attached to the plant.

6. ___________

This type of insect is a voracious feeder that can cause damage to foliage and fruit. They have worm-like, segmented bodies and grow through stages called instars.

7. Which of the following is a chewing insect?
   a. Leafhopper
   b. Aphid
   c. Nematode
   d. Japanese beetle

8. Mites are a common pest on fruits and vegetables ingesting sap from leaves. Which of the following is a cultural control of mites?
   a. Insecticide
   b. Irrigation and moisture management
   c. Lady beetles
   d. Horticultural oil

9. What is NOT a characteristic of a systemic insecticide?
   a. They are primarily taken up by the roots
   b. Small aerosol droplets are most effective
   c. They are transported throughout the plant
   d. They are effective for a long period of time
5. **Correct answer: D**
Explanation: Scale vary from very small, waxy covered objects to pearl-like objects. They secrete a waxy coating for defense, which causes them to resemble fish scales, hence the name. With the waxy coating, they are very resistant to insecticides, which are only effective against the nymph or crawler stage. Scales can be controlled with horticultural oils, which suffocate them.

6. **Correct answer: B**
Explanation: Caterpillars are the young larvae form of butterflies or moths and are considered very serious pests in crops. Examples would be, corn earworm, loopers, fruit worms, hornworms and borers. Traps can be used to monitor some populations to determine when control is needed.

7. **Correct answer: D**
Explanation: Insects with chewing mouthparts create noticeable holes in leaves or fruit. Insecticides that lay on the surface of the plant may be effective as these insects often consume more of the surface area of plants than insects with piercing-sucking mouthparts. With piercing-sucking insects, such as leafhoppers and aphids, the mouthparts form a tube which is inserted into a food source. Therefore the type of mouthpart can affect control decisions. Nematodes are microscopic roundworms in the soil. Japanese beetle is a chewing-insect pest of many crops and can often defoliate the plant.

8. **Correct answer: B**
Explanation: Adequate overhead irrigation or frequent rain showers can limit the plant stress mite outbreaks may cause. Mites feed under hot, dry conditions. Their natural enemies are stressed by arid conditions and drought-stressed plants can produce a change in their chemistry that make them more nutritious to mites.

9. **Correct answer: B**
Explanation: Since the insecticide is taken up by the plant and kills insects feeding on the plant, complete coverage of the plant is not as important, as with contact materials.
10. A contact insecticide:
   a. Must be ingested to be effective
   b. Moves within the plant
   c. Kills insects by direct contact with the spray
   d. All of the above

11. Seed treatments would be used to manage:
   a. Pythium and other fungi
   b. Soil insects
   c. Germinating weed seeds
   d. A and B

12. How are pheromones used as non chemical tactics for insect control?
   a. Monitoring of insect populations
   b. Mass trapping of insects
   c. Mating disruption
   d. All the above

13. Which of the following is a general chewing insect pest that will feed on most fruit and vegetable crops?
   a. Leafhopper
   b. Aphid
   c. Mite
   d. Japanese beetle

14. Caterpillars can be controlled with biological controls including:
   a. Parasitoids
   b. Bt
   c. Predators
   d. All of the above

15. Vegetable crops that are being repeatedly treated with broad-spectrum insecticides may have a build up aphids or spider mites because:
   a. Soil conditions were not moderate
   b. The natural enemies of these pests were eliminated
   c. Weed pressure caused increased insect populations
   d. A broad-spectrum fungicide should have been used
10. **Correct answer: C**  
Explanation: A contact insecticide kills insects on contact. No ingestion is necessary. Application coverage must be very good; usually, small aerosol droplets are best, but control is short-lived.

11. **Correct answer: D**  
Explanation: Insecticide seed treatments are used to control insects and prevent damage to seeds and seedlings. Cool wet soils tend to be the most conducive conditions for damage to seedlings. Seed treatments are useful for many vegetables to prevent damping off and other diseases. Methods include hot water treatments, fungicide seed treatments and bleach treatments.

12. **Correct answer: D**  
Explanation: Pheromones affect insect behavior. There are three uses of pheromones to manage insects without chemicals. One use is the monitoring of specific insect populations to decide if protection methods should be started and when. Mass trapping to remove large numbers of insects can be another effective use of pheromones such as codling moth and yellow jackets. The third is using pheromones for mating disruption. Pheromones are released to disrupt the males who are unable to locate females so the number of matings and offspring are reduced.

13. **Correct answer: D**  
Explanation: The Japanese beetle is a serious pest of over 200 plant species including vine crops, grapes and many other fruits and vegetables. The beetle damages the plant by skeletonizing the foliage, consuming the leaf material between the veins.

14. **Correct answer: D**  
Explanation: Caterpillars are susceptible to several biological controls. Parasitoids are insects that commonly attack soft-bodied hosts such as caterpillars. Bt, also known as Bacillus thuringiensis, is a pathogen that affects caterpillars. Predators often attack immobile prey, especially the egg stage of caterpillars.

15. **Correct answer: B**  
Explanation: Natural enemies, such as predators or parasites, can help manage pests. Care should be taken with broad-spectrum treatments so that natural predators, such as lady beetles, are not affected. Aphids and spider mites are relatively slow-moving, which makes them vulnerable to predators.
Fruit & Vegetable Common Weeds & Management

For questions 16-21, complete the table by writing the letter of each weed next to the picture and indicate if the weed is an annual or perennial. Note: All questions on the exam will be multiple choice.

Possible Answers:
   a. Chickweed
   b. Shepherdspurse
   c. Henbit
   d. Canada Thistle

16. __________
   This weed forms a large mat of foliage.
   Check one: ☐ Perennial or ☐ Annual

17. __________
   This weed has a rosette of heart-shaped leaves.
   Check one: ☐ Perennial or ☐ Annual

18. __________
   This weed grows tall with purplish flowers and has extensive, underground rhizomes.
   Check one: ☐ Perennial or ☐ Annual

19. __________
   This weed has square stems and tiny pink-purple flowers.
   Check one: ☐ Perennial or ☐ Annual
Fruit & Vegetable Commond Weeds & Management – Answers

16. Correct answer: A
   Explanation: Chickweed is a winter annual that grows in a large, low mat of foliage. The weed has tiny pointed leaves and small white flowers.

17. Correct answer: B
   Explanation: Shepherd's-purse is a winter annual with a rosette of heart-shaped or “purse”-shaped leaves. The tiny white flowers grow on a long stem.

18. Correct answer: D
   Explanation: Canada thistle is a creeping, broadleaf perennial weed that grows aggressively and reproduces by seed, as well as extensive, underground rhizomes. Canada thistle has a rosette of leaves as an immature plant and can grow tall with purplish flowers.

19. Correct answer: C
   Explanation: Henbit is a winter annual with square stems and tiny, pink-purple flowers.
Possible Answers:
   a. Quackgrass
   b. Dandelion
   c. Henbit
   d. Chickweed

20. __________
   This weed has a bright, yellow flower and a long taproot.
   Check one: ☐ Perennial or ☐ Annual

21. __________
   This weed has extensive underground rhizomes.
   Check one: ☐ Perennial or ☐ Annual

22. What is the best timing for controlling perennial weeds in vegetable and small fruit plantings?
   a. After flowering
   b. In the bud stage
   c. Before planting
   d. At planting

23. A good weed control program will utilize as many practices as possible to minimize weed populations including cultural practices. Which of the following is not a cultural practice?
   a. Crop rotation
   b. Herbicides
   c. Cultivation
   d. Mulches

24. What are some weed control methods that can be done before a crop is planted?
   a. Spray to control pre-existing weeds
   b. Cover crops
   c. Cultivation
   d. All of the above
20. **Correct answer: B**  
Explanation: Dandelion is a broadleaf perennial with a recognizable bright, yellow flower. The weed has a long taproot and produces many seeds.

21. **Correct answer: C**  
Explanation: Quackgrass is a grassy perennial that spreads and reproduces by extensive underground rhizomes.

22. **Correct answer: C**  
Explanation: Once a crop is planted, perennials are very difficult to control. Timing for control is important for perennials. Some are most susceptible during the bud to bloom stage when the sugars and food produced by the plant are moving to the roots. Overall, most perennial weeds are best controlled in the fall. If possible, eliminate all perennial weeds before establishing a new crop by using a planned program of tillage and herbicides.

23. **Correct answer: B**  
Explanation: Cultural controls can supplement the control provided by herbicides or may serve as the only weed control when no herbicides are available or when the grower decides against their use. Like herbicide control, timing is important when using cultivation. Crop rotation, crop competition and the use of mulches are also practices referred to as cultural controls.

24. **Correct answer: D**  
Explanation: Before a fruit crop is established or an annual vegetable crop is planted, every effort should be made to eliminate existing weeds. Burndown, or nonselective spraying, will help control weeds that are already present. Cover crops, such as ryegrass, can be used to crowd out weeds. The cover crop can then be controlled so the fruit or vegetable can flourish. Cultivation, such as plowing or disking, can help eliminate existing weeds, especially annuals.
25. What cultural control(s) will help weed competition with the crop?
   a. Barriers such as plastic mulch
   b. Cover crops
   c. Cultivation
   d. All of the above

26. What are some cultural weed controls that can be done after a crop is planted?
   a. Mulches
   b. Cultivation
   c. Sodding/cover crops
   d. All of the above

27. A preemergence application is:
   a. Applied after weed problem occurs
   b. Susceptible to soil conditions
   c. Used for established perennial weeds
   d. All of the above

28. A postemergence application is:
   a. Used to spot treat
   b. Less susceptible to soil conditions
   c. Used in all tillage systems
   d. All of the above

29. If a grower has grass growing under his apple trees, what type of herbicide application would be required to kill the grass?
   a. Preemergence
   b. Postemergence
   c. Preplant incorporated
   d. None of the above

30. Winter annuals are best controlled with a preemergence herbicide in the:
   a. Summer
   b. Fall
   c. Winter
   d. Spring
25. **Correct answer: D**  
Explanation: Cultural controls will help reduce weed pressure on the growing crops. Barriers such as plastic mulch and landscape fabric can be used. Cover crops and cultivation can also be incorporated into a pest management system.

26. **Correct answer: D**  
Explanation: Cultural weed control are management practices to reduce weed competition with the crop. Mulches can be plastic around the crop to keep weeds from growing. Cultivation is most effective with annual weeds when weeds are young and small. Sodding with grass or cover crops are used in perennial crops, such as orchards, to reduce weed growth between the fruit rows.

27. **Correct answer: B**  
Explanation: Preemergence herbicides are applied to the soil surface after the crop is planted but before crop seedlings and weeds appear above ground. Rainfall is required for good herbicide activity to move the herbicide down into the upper layers of soil where the weed seeds are. As the seeds germinate they take in water and herbicide, and the young seedlings are killed. While preemergents will control perennial weeds beginning from seed there will be no control of established perennial weeds.

28. **Correct answer: D**  
Explanation: Postemergence herbicides are applied after the crop and weeds have emerged. Most postemergence herbicides have foliar activity only, but a few do provide some soil activity. Soil type does not affect herbicide activity and can be used in any tillage system. However, application timing is critical for good weed control and to avoid crop injury. Most postemergence herbicides work best when weeds are young and actively growing. Labels may give recommendations on the size of weeds to time applications.

29. **Correct answer: B**  
Explanation: A postemergence treatment with either a contact or systemic herbicide would be required since the crop and weed are already growing and a soil application would not be possible. Fruit trees are not immune to herbicide injury, especially with younger trees or on sandy soils. To avoid the potential of herbicide injury, read and follow all label directions.

30. **Correct answer: B**  
Explanation: Winter annuals complete their life cycle in one year. Winter annuals germinate in the fall, over winter and flower in the spring. This makes them very competitive with fruit and vegetable crops because they can out compete the young crop. Preemergent herbicides can be used for winter annual control, but must be applied in the fall. Preventing seed productions is the best long-term strategy for annual weeds.
31. Summer annuals germinate in the:
   a. Spring
   b. Summer
   c. Fall
   d. Winter

32. The optimal time to control perennial broadleaf weeds is when:
   a. Leaves are developing
   b. Sugars are moving to roots
   c. Weed has been frosted
   d. Weed is dormant
31. **Correct answer: A**  
Explanation: Summer annuals germinate in spring so they germinate with annual crops and compete for water and nutrients. The critical weed-free period is the length of time usually measured from planting, that weeds must be controlled to achieve maximum yield. After that period, weeds do not affect yield. For many vegetable crops, it is 4-6 weeks. However, weeds will produce seed for future and may interfere with harvest. Most problems in vegetable fields are summer annuals or creeping perennials.

32. **Correct answer: B**  
Explanation: Perennials persist year after year and represent some of the worst weed problems in Ohio. Most spread and reproduce through underground rhizomes, roots or nutlets so preemergence herbicides offer little control. The herbicide to control these must kill the plant above ground, as well as the below ground structures. The optimum time for control is when the weed is storing sugars in the roots. For most perennial broadleaf weeds this happens when the plant is blooming. When leaves are developing the nutrients are moving upwards to the new leaves and the herbicide will not travel to the roots.
Fruit & Vegetable Disease Groups & Management

For Questions 33-38, complete the table by writing the letter of each disease next to the picture. Note: All questions on the exam will be multiple choice.

Possible Answers:
   a. Fungal leaf spots
   b. Mildews
   c. Rust
   d. Scab

33. __________  34. __________

These diseases are easy to spot with dusty white to gray coating on leaf surfaces.

The symptoms of these diseases are brown to black spots across the leaf surfaces.

35. __________  36. __________

Red/orange to brown spots and disfigured leaves are symptoms of these diseases.

Warty dark lesions on the leaf or fruit is seen with these diseases.
33. **Correct answer: B**
Explanation: Mildews are some of the most common plant disease fungi. Splotches of white/gray powdery mold on the leaf and stem are the symptoms. Examples are powdery mildew and downy mildew. However, powdery mildew and downy mildews are very different disease types and are controlled by different fungicides. Downy mildew fungi are more often seen on the leaf underside, while powdery mildew occur more on the upper leaf surface or fruit.

34. **Correct answer: A**
Explanation: Fungal leaf spot is a general term used to describe fungus symptoms on infected plants. The appearance of the spots vary among diseases such as Septoria, gray leaf spot, early blight, and late blight. A protectant fungicide should be applied before the disease develops lesions on the plant. A curative fungicide may be used to stop the process of infection, but must be used very early in the infection process. A protectant fungicide will give the most control.

35. **Correct answer: C**
Explanation: Rust is a fungal disease with unique symptoms of orange to brown pustules over the upper or lower side of leaf surfaces depending on the specific disease. Examples are common rust and striped rust.

36. **Correct answer: D**
Explanation: Scab initial symptoms are brown to olive green lesion which expand and merge together. Leaves often curl, turn yellow, and fall off the tree. Scab also affects the fruit if not controlled. Scab is caused by a fungus.
Possible Answers:
   a. Bacterial Leaf Spot
   b. Viruses
   c. Scab
   d. Rust

37. __________

This disease has symptoms of pale, green water-soaked lesions.

38. __________

These diseases have yellow, ring spots or circular blotches.

39. What conditions need to be present for a plant to become diseased?
   a. A pathogen
   b. A susceptible host
   c. Proper environmental conditions
   d. All the above

40. An organism that causes disease is called a:
   a. Predator
   b. Pathogen
   c. Parasitoid
   d. Parasite

41. The largest number of plant diseases are caused by:
   a. Viruses
   b. Fungi
   c. Bacteria
   d. Nematodes

42. What disease-causing pathogen needs a vector such as insects to enter the plant?
   a. Nematodes
   b. Bacteria
   c. Virus
   d. Fungi
37. **Correct answer: A**
Explanation: Bacterial leaf spots on infected plants have brown to black water soaked lesions with a yellow halo during warm, moist periods. As the name implies, bacterial leaf spot is caused by a bacteria. Because of this, fungicides will have no effect on these diseases. A bactericide will need to be used.

38. **Correct answer: B**
Explanation: Virus symptoms range from yellow circular lesions to stunting, yellowing, and mottling of older leaves. Viruses are vectored by insects or through physical wounding or mechanical injury and during propagation, etc. Controlling the vector, such as an insect, is necessary to control diseases caused by a virus.

39. **Correct answer: D**
Explanation: This concept is called the disease triangle. For plant disease to occur there must be a susceptible plant, a pathogen that can cause disease and the proper environment for that disease to grow. These three conditions must come together at the same time. A disease outbreak will not occur if one of these is missing.

40. **Correct answer: B**
Explanation: A pathogen is an organism that causes disease in a plant. There are numerous types of pathogens including viruses, bacteria and fungi.

41. **Correct answer: B**
Explanation: Fungi are the largest group of plant disease-causing pathogens. They spread by spores and survive on dead crop residue left on the soil surface. Examples are mildews, rusts, and fungal leaf blights.

42. **Correct answer: C**
Explanation: Virus diseases, such as leaf mosaics, mottling or stunting, require transmission by an insect vector. Virus pathogens cannot penetrate plant cell walls so insects, such as aphids, leafhoppers and beetles are vectors that spread virus by feeding on the plant and carrying the virus.
43. Bacterial diseases:
   a. Enter plants through wounds and natural openings
   b. Are controlled by bacteriacides
   c. Cause blighted areas that often look water-soaked
   d. All of the above

44. What is an example of an IPM chemical management measure?
   a. Crop rotation
   b. Bt bacterium
   c. Foliar fungicide
   d. The use of mulch

45. A biological IPM management tool for controlling diseases is:
   a. Predators
   b. Bacterium
   c. Parasitoids
   d. All of the above

46. Which of the following is not a cultural control strategy?
   a. Fungicides
   b. Crop rotation
   c. Raised beds
   d. Trellising

47. Which of the following is a root disease?
   a. Rust
   b. Septoria
   c. Phytophthora
   d. Powdery mildew

48. How do most fungicides control fungal leaf spot diseases?
   a. Move systemically within the plant to eradicate disease
   b. Act as a surface barrier when applied to the soil
   c. A control when applied after the fungi have infected the plant
   d. A protective barrier when applied before infection occurs.

49. What general practice in annual crops helps reduce disease problems?
   a. Cultivation
   b. Crop rotation
   c. Irrigation
   d. Early planting
43. **Correct answer: D**
Explanation: Bacteria cannot penetrate plant tissue, so they must enter through wounds or natural openings, such as stomata. Common symptoms include leaf spots, blights and wilting. Borders around the leaf spots or blighted areas often look “water-soaked.” Bacterial diseases of the leaf can be controlled, but prevention should be the aim. Fungicides will not control bacteria so a bactericide, such as streptomycin or fixed copper, must be used. Using disease-free seed is also important for some annual crops.

44. **Correct answer: C**
Explanation: IPM chemical management measures the use of pesticides. Depending on the pest, the pesticides should be used after scouting the crop and finding disease at or near economic threshold levels.

45. **Correct answer: B**
Explanation: Bacterium and other biological fungicides are very low toxicity to humans. They need to be used as a preventative treatment rather than a cure for a disease. Biofungicides are deployed before an economic threshold is reached.

46. **Correct answer: A**
Explanation: Cultural controls are preventative measures, such as selecting varieties, crop rotation, sanitation and planting in well-drained soils to reduce disease levels.

47. **Correct answer: C**
Explanation: Phytophthora root rot survives in heavy wet soil and is spread by spores in the soil. High humidity with temperatures above 85 favors infection in the plant. Phytophthora can be managed with crop rotation, clean seed or transplants, proper seedbed preparation, drainage and use of a fungicide seed treatment.

48. **Correct answer: D**
Explanation: For leaf spots, a protectant fungicide should be applied before the disease develops lesions on a plant leaf. A **lesion** is another term for a diseased spot or area on a plant. The fungicide acts as an external shield, almost like a coat of paint. New growth is unprotected until the next application is applied. A **curative** fungicide stops the process of infection that may have occurred hours or a few days before. They must be used very early in the infection process and will not cure diseases in an advanced stage.

49. **Correct answer: B**
Explanation: Pathogens over winter and survive on plant residue on the soil surface and in the soil. By rotating to a nonsusceptible crop the pathogen levels can be reduced.
<table>
<thead>
<tr>
<th>Number of Questions Answered Correctly</th>
<th>Percent Correct</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>74-82</td>
<td>&gt;90%</td>
<td><strong>Excellent:</strong> You have a very good understanding of areas addressed in this student workbook.</td>
</tr>
<tr>
<td>66-73</td>
<td>&gt;80%</td>
<td><strong>Good:</strong> 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.</td>
</tr>
<tr>
<td>58-65</td>
<td>&gt;70%</td>
<td><strong>Needs Improvement:</strong> Your score indicates a borderline level of expertise. Be sure to re-read the study material and re-answer the questions you missed.</td>
</tr>
<tr>
<td>0-57</td>
<td>&lt;70%</td>
<td><strong>Study Needed:</strong> Re-read the study material and work through sections of the workbook again.</td>
</tr>
</tbody>
</table>
Additional Study Aids

Fruit and Vegetable Crops Label - Remote Channel .................... page 50
(to be used with questions earlier in the study guide)

Pest Color Images
Common Fruit & Vegetable Crop Insects.................................
Remote Channel

GROUP 11 Fungicide

Remote Channel EG Fungicide Product Label

For use in berries, bulb vegetables, cherry, cucurbit vegetables, fruiting vegetables, root vegetables and strawberries.

Active Ingredient:
Pyraclostrobin (carbamic acid, [2-[[1-4-chlorophenyl]-1H-pyrazol-3-y]ox][methyl][phenyl]methoxy•methyl ester) 20.0%
Inert ingredients .......................................................... 80.0%
Total.................................................................................. 100.0%
EPA Reg. No.: 12345-09
Establishment No.: 295-NE-5

CAUTION
Keep Out of Reach of Children

Precautionary Statements
Hazard to Humans and Domestic Animals
Caution
Harmful if swallowed or absorbed through skin. Causes moderate eye irritation. Avoid contact with eyes, skin or clothing.

Personal Protective Equipment (PPE)
Some materials that are chemically resistant to this product are listed below. For more options, refer to category A on an EPA chemical resistance category selection chart.
• Applicators and handlers must wear:
  • Long-sleeved shirt and long pants
  • Chemical-resistant gloves made of any waterproof materials (such as Nitrile, Butyl, Neoprene, and/or Barrier Laminate)
  • Shoes plus socks

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.

Engineering Controls Statement
When handlers use closed systems, enclosed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standards (WPS) for agricultural pesticides [40 CFR 179.240(d)(4-6)], the handler PPE requirements may be reduced or modified as specified in the WPS.

First Aid

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 on skin or clothing
• Take off contaminated clothing.
• Rinse skin immediately with plenty of water for 15-20 minutes.
• Call a poison control center or doctor for treatment advice.

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

If inhaled
• Move person to fresh air
• If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible.
• Call a poison control center or doctor for further treatment advice.

Hot Line Number
Have the product container or label with you when calling a poison control center or doctor or going for treatment. You may also contact this number for emergency medical treatment information: 1-800-858-7378
Remote Channel

Environmental Hazards
This product may contaminate water through drift of spray in wind. This product has a potential for runoff for several months or more after application. Poorly draining soils and soils with shallow water tables are more prone to produce runoff that contains this product. A level, well-maintained vegetative buffer strip between areas to which this product is applied and surface water features such as ponds, streams and springs will reduce the potential for contamination of water from rainfall-runoff. Runoff of this product will be reduced by avoiding applications when rainfall is forecasted to occur within 48 hours. Sound erosion control practices will reduce this product’s contribution to surface water contamination.

This pesticide is toxic to fish and aquatic invertebrates. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Do not apply directly to water, areas where surface water is present, or intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash waters or rinsate.

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

- **Pesticide Storage:** Store in original containers only. Keep container closed when not in use. Do not store near food or feed. In case of spill on floor or paved surfaces, mop and remove to chemical waste storage area until proper disposal can be made if product cannot be used according to label.
- **Pesticide Disposal:** Wastes resulting from using this product may be disposed of on site or at an approved waste disposal facility. If these wastes cannot be disposed of according to label instructions, contact your State Pesticide Control Agency, or the Hazardous Waste representatives at the nearest EPA Regional Office for guidance.
- **Container Disposal:** Triple rinse (or equivalent). Puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.

In Case of Spill
In case of large-scale spillage regarding this product, call Chemtrec at 800-424-9300

**Steps to be taken in case material is released or spilled:**
Dike and contain spill with inert material (sand, earth, etc.) and transfer liquid and solid diking material to separate containers for disposal. Remove contaminated clothing, and wash affected skin areas with soap and water. Wash clothing before re-use. Keep the spill out of sewers and open bodies of water.

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), notification of workers, and restricted-entry interval. The requirements in this box only apply to the 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 for all crops except berries. REI for treated berries is 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
- Chemical-resistant gloves made of any waterproof material (such as Nitrile, Butyl, Neoprene, and/or Barrier Laminate)
- Shoes plus socks

I. General Information
This package contains Remote Channel EG fungicide, a water dispersable granule (EG). The active ingredient pyraclostrobin, is a member of the **strobilurin class of chemistry** and is derived from a natural antifungal substance. Optimum disease control is achieved when Remote Channel is applied in a regularly scheduled protective spray program and is used in a rotation program with other fungicides. Because of its high specific activity, Remote Channel has good residual activity against target fungi.

Remote Channel is not for use in greenhouse or transplant production.
Remote Channel

Mode of Action
Pyraclostrobin, the active ingredient of Remote Channel belongs to the group of respiration inhibitors classified by the U.S. EPA and Canada PMRA as Quinone Outside Inhibitors (Qol), or Target Site of Action Group 11 Fungicides.

Resistance Management
Remote Channel contains pyraclostrobin, a Group 11 fungicide, and is effective against pathogens resistant to fungicides with modes of action different from those of Qol fungicides (Target Site Group 11), such as, dicarboximides, sterol inhibitors, benzimidazoles, or phenylamides. Fungal isolates resistant to Group 11 fungicides, such as pyraclostrobin, azoxystrobin, trifloxystrobin, and kresoxim-methyl, may eventually dominate the fungal population if Group 11 fungicides are used predominantly and repeatedly in the same field in successive years as the primary method of control for the targeted pathogen species. This may result in reversion of disease control by Remote Channel or other Group 11 fungicides.

To maintain the performance of Remote Channel EG fungicide in the field, do not exceed the total number of sequential applications of Remote Channel and the total number of applications of Remote Channel per season stated in Sections V. and VI. Adhere to the label instructions regarding the consecutive use of Remote Channel or other target site of action Group 11 fungicides that have a similar site of action on the same pathogens.

The following recommendations may be considered to delay the development of fungicide resistance:

1. Tank mixtures: Use tank mixtures with fungicides from different Target Site of Action Groups that are registered/ permitted for the same use and that are effective against the pathogens of concern. It is recommended to use at least the minimum labeled rates of each fungicide in the tank mix.

2. IPM: Remote Channel should be integrated into an overall disease and pest management program. Cultural practices known to reduce disease development should be followed. Consult your local extension specialist, certified crop advisor and/or company representative for additional IPM strategies established for your area. Remote Channel may be used in Agricultural Extension advisory (disease forecasting) programs, which recommend application timing based on environmental factors favorable for disease development.

3. Monitoring: Monitor efficacy of all fungicides used in the disease management program against the targeted pathogen and record other factors that may influence fungicide performance and/or disease development. If a Group 11 target site fungicide, such as Remote Channel, appears to be less effective against a pathogen that it previously controlled or suppressed, contact a company representative, local extension specialist, or certified crop advisor for further investigation.

Cleaning Spray Equipment
Spraying equipment must be cleaned thoroughly before and after applying this product, particularly if a product with potential to injure crops was used prior to Remote Channel.

II. Application Instructions

Apply recommended rates of Remote Channel as instructed by Section VI. Crop-Specific Recommendations. Apply Remote Channel with ground sprayer, aerial equipment or through sprinkler irrigation equipment. Equipment should be checked frequently for calibration. Under low-level disease conditions, the minimum application rates can be used while maximum application rates and shortened spray schedules are recommended for severe or threatening disease conditions. Do not apply when conditions favor drift from target area or when wind speed is greater than 6 mph.

Ground Application: Apply Remote Channel in sufficient water to ensure thorough coverage of foliage, bloom, and fruit. Thorough coverage is required for optimum disease control.

Aerial Application: Use no less than 5 gallons of spray solution per acre. For aerial application to tree crops, use no less than 10 gallons of spray solution per acre.

Directions for Use through Sprinkler Irrigation Systems

Sprayer Preparation: Chemical tank and injector system should be thoroughly cleaned. Flush system with clean water.

Application Instructions: Apply Remote Channel at rates and timings as described in this label.

Use Precautions for Sprinkler Irrigation Applications:
- Apply this product only through sprinkler irrigation systems including center pivot, lateral move, end tow, side [wheel] roll, traveler, big gun, solid set, or hand move irrigation systems. Do not apply this product through any other type of irrigation system.
- Add this product to the pesticide supply tank containing sufficient water to maintain a continuous flow by the injection equipment. In continuous moving systems, inject this product-water mixture continuously, applying the labeled rate per acre for that crop. Do not exceed ½ inch (13,577
Remote Channel

gallons) per acre. In stationary or non-continuous moving systems, inject the product-water mixture in the last 15-30 minutes of each set allowing sufficient time for all of the required pesticide to be applied by all the sprinkler heads and applying the labeled rate per acre for that crop. Do not apply when wind speed favors drift beyond the area intended for treatment. Crop injury, lack of effectiveness, or illegal pesticide residues in the crop can result from non-uniform distribution of treated water. Thorough coverage of foliage is required for good control. Good agitation should be maintained during the entire application period.

- If you have questions about calibration you should contact State Extension Service specialist, equipment manufacturers or other experts.
- 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.
- The pesticide injection pipeline must contain a functional, automatic, quick-closing check valve to prevent the flow of fluid back toward the injection pump.
- 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.
- The system must contain functional interlocking controls to automatically shut off the pesticide injection pump when the water pump motor stops.
- 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.
- 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.
- Allow sufficient time for pesticide to be flushed through all lines and all nozzles before turning off irrigation water. A person knowledgeable of the chemigation system and responsible for its operation, or under supervision of the responsible person, shall shut the system down and make necessary adjustments should the need arise.
- Do not connect an irrigation system (including greenhouse systems) used for pesticide application to a public water system unless the pesticide label prescribed safety devices for public water systems are in place.

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 end 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 injection pipeline must 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.
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.

III. Additives and General Tank Mixing Information

Remote Channel fungicide can be tank mixed with most recommended fungicides, insecticides, herbicides, liquid fertilizers, biological control products, adjuvants, and additives as specified in Section VI. Crop-Specific Recommendations.

Under some conditions, the use of additives or adjuvants may improve the performance of Remote Channel. However, all varieties and cultivars have not been tested with possible tank mix combinations. Local conditions can also influence crop tolerance and may not match those under which the manufacturer has conducted testing.

Physical incompatibility, reduced disease control, or crop injury may result from mixing Remote Channel with other products.
Remote Channel

Therefore, before using any tank mix (fungicides, insecticides, herbicides, liquid fertilizers, biological control products, adjuvants, and additives), test the combination on a small portion of the crop to be treated to ensure that a phytotoxic response will not occur as a result of application.

IV. Mixing Order

2. Agitation. Maintain constant agitation throughout mixing and application.
3. Inductor. If an inductor is used, rinse it thoroughly after each component has been added.
4. Products in PVA bags. Place any product contained in water-soluble PVA bags into the mixing tank. Wait until all water-soluble PVA bags have fully dissolved and the product is evenly mixed in the spray tank before continuing.
5. Water-dispersible products (such as Remote Channel EG fungicide, dry flowables, wettable powders, suspension concentrates, or suspo-emulsions).
7. Emulsifiable concentrates (such as oil concentrates when applicable).
8. Water-soluble additives (such as AMS or UAN when applicable).
9. Remaining quantity of water.

Make sure that each component is thoroughly mixed and suspended before adding tank mix partners. Maintain constant agitation during application. See Section VI. Crop-Specific Recommendations for more details.

V. General Restrictions and Limitations

All Crops

- Maximum seasonal use rate: Do not apply more than the maximum rate per acre per season as listed in Table A. Crop-Specific Restrictions and Limitations and Section VI. Crop-Specific Recommendations.
- Maximum rate per application: Do not apply more than the maximum rate per acre per application as listed in Table A. Crop-Specific Restrictions and Limitations and Section VI. Crop-Specific Recommendations.
- Do not make more than the total number of applications of Remote Channel per season, as listed in Table A. Crop-Specific Restrictions and Limitations and not exceeding the maximum seasonal use rate. Also see Section VI. Crop-Specific Recommendations.
- Pre-harvest Interval (PHI): See Table A. Crop-Specific Restrictions and Limitations and Section VI. Crop-Specific Recommendations.
- Remote Channel is not for use in greenhouse or transplant production.

Crop Rotation Restriction: Crops listed on the Remote Channel fungicide label may be planted immediately following the last application.

All other crops can be planted 14 days after the last application.
## Table A. Crop-Specific Restriction and Limitations

<table>
<thead>
<tr>
<th>Crop</th>
<th>Minimum Time from Application to Harvest (PHI) (days)</th>
<th>Maximum Rate per Acre per Application (oz.)</th>
<th>Maximum Number of Sequential Applications</th>
<th>Maximum Number of Applications per Season</th>
<th>Maximum Rate per Acre per Season (oz.)</th>
<th>Livestock Grazing or Feeding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berry Group: Blueberry, Caneberry, Raspberry</td>
<td>0</td>
<td>14</td>
<td>2</td>
<td>4</td>
<td>56</td>
<td>NA</td>
</tr>
<tr>
<td>Bulb Vegetables Group¹: Onion, Garlic, Leeks</td>
<td>7</td>
<td>12</td>
<td>2</td>
<td>6</td>
<td>72</td>
<td>NA</td>
</tr>
<tr>
<td>Cherry (sweet and tart)</td>
<td>0</td>
<td>9.5</td>
<td>2</td>
<td>5</td>
<td>47.5</td>
<td>NA</td>
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<tr>
<td>Cucurbit Vegetables Group¹: Cantaloupe, Cucumber, Melon, Squash, Pumpkin, Watermelon</td>
<td>0</td>
<td>16</td>
<td>1</td>
<td>4</td>
<td>64</td>
<td>NA</td>
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<tr>
<td>Fruiting Vegetables Group¹: Tomato, Bell pepper, Chili pepper, Eggplant</td>
<td>0</td>
<td>16</td>
<td>2</td>
<td>6</td>
<td>96</td>
<td>NA</td>
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<tr>
<td>Root Vegetables (except sugar beet) Subgroup: Carrot, Radish (roots &amp; tops)</td>
<td>0</td>
<td>16</td>
<td>2</td>
<td>3</td>
<td>48</td>
<td>Yes for carrot culls</td>
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<tr>
<td>Strawberries</td>
<td>0</td>
<td>14</td>
<td>2</td>
<td>5</td>
<td>70</td>
<td>NA</td>
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</tbody>
</table>

¹ For a complete list of crops within a crop group, see Section VI. Crop-Specific Recommendations.

NA = not applicable

Aerial Application is permitted for all labeled crop uses.
Remote Channel

VI. Crop-Specific Recommendations

<table>
<thead>
<tr>
<th>Crop</th>
<th>Target Diseases</th>
<th>Use Rate per Application</th>
<th>Maximum Number of Applications per Season</th>
<th>Maximum Rate per Season</th>
<th>Minimum Time from Application to Harvest (PHI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Berry Group</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blackberry (all varieties)</td>
<td>Alternaria leaf spot and fruit rot (<em>Alternaria spp.</em>)</td>
<td>14 oz. per acre</td>
<td>4</td>
<td>56 oz. per acre</td>
<td>0 days</td>
</tr>
<tr>
<td>Blueberry</td>
<td>Anthracnose (<em>Colletotrichum spp., Elsinoe spp.</em>)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currant</td>
<td>Leaf spot and blotch (<em>Mycosphaerella spp., Septoria spp.</em>)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elderberry</td>
<td>Phomopsis leaf spot, twig blight, and fruit rot (<em>Phomopsis spp.</em>)</td>
<td></td>
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<tr>
<td>Gooseberry</td>
<td>Powdery mildew (<em>Sphaerotheca spp., Microsphaera spp., Oidium spp.</em>)</td>
<td></td>
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</tr>
<tr>
<td>Huckleberry</td>
<td>Rust (<em>Pucciniastrum spp., Arthuriomyces spp., Phragmidium spp., Kuehneola spp.</em>)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loganberry</td>
<td>Spur blight (<em>Didymella spp., Phoma spp.</em>)</td>
<td></td>
<td></td>
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<tr>
<td>Raspberry (black and red)</td>
<td><strong>Suppression only</strong> Botrytis gray mold (<em>Botrytis cinerea</em>)</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Monilinia blight (<em>Monilinia spp.</em>)</td>
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</tbody>
</table>

**Application Directions:** Begin applications of Remote Channel fungicide prior to disease development and continue on a 7- to 14-day interval. Use the shorter interval when disease pressure is high. Do not enter treated area within 24 hours of the most recent application. Refer to the “Agricultural Use Requirements” box on page 3 for PPE required for early entry to treated areas as permitted under the Worker Protection Standard.

**Resistance Management:** To limit the potential for development of resistance, do not make more than four (4) applications of Remote Channel or other strobilurin (QoI) fungicides per season. Do not make more than two (2) sequential applications of Remote Channel before alternating to a labeled non-strobilurin (non-QoI) fungicide with a different mode of action.
## Remote Channel

<table>
<thead>
<tr>
<th>Crop</th>
<th>Target Diseases</th>
<th>Use Rate per Application</th>
<th>Maximum Number of Applications per Season</th>
<th>Maximum Rate per Season</th>
<th>Minimum Time from Application to Harvest (PHI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bulb Vegetables Group</strong></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
| Onions (all varieties) | Alternaria purple blotch  
* (Alternaria porri)* | 8 to 12 oz. per acre | 6                          | 72 oz. per acre                      | 7 days                                            |
| Garlic             | Powdery mildew  
* (Leveillula taurica)* |                          |                                          |                         |                                               |
| Leek               | Downy Mildew  
* (Peronospora destructor)* | 12 oz. per acre          |                                          |                         |                                               |
| **Shallot**        |                                             |                          |                                          |                         |                                               |

**Application Directions:** For control of Alternaria purple blotch and powdery mildew, begin applications of Remote Channel fungicide prior to disease development and continue on a 14-day interval.

Use the higher rate when disease pressure is high.

Applications made to control Alternaria purple blotch and powdery mildew will also suppress downy mildew. To achieve adequate control of downy mildew, apply Remote Channel at the first sign of disease, then follow Remote Channel with a labeled non-strobilurin (non-QoI) fungicide 5 to 7 days later. Do not make sequential applications of Remote Channel when downy mildew occurs. See **Resistance Management** statement below.

**Resistance Management:** To limit the potential for development of resistance, do not make more than six (6) applications of Remote Channel or other strobilurin (Qol) fungicides per season.

Do not make more than two (2) sequential applications of Remote Channel before alternating to a labeled non-strobilurin fungicide with a different mode of action.

For downy mildew, do not make more than one (1) application of Remote Channel before alternating to a labeled non-strobilurin fungicide with a different mode of action.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Target Diseases</th>
<th>Use Rate per Application</th>
<th>Maximum Number of Applications per Season</th>
<th>Maximum Rate per Season</th>
<th>Minimum Time from Application to Harvest (PHI)</th>
</tr>
</thead>
</table>
| **Cherry** (sweet and tart) | Monilinia blossom blight  
* (Monilinia spp.)* | 9.5 oz. per acre | 5                          | 47.5 oz. per acre                      | 0 days                                           |
|                     | Powdery mildew  
* (Sphaerotheca spp., Podosphaera spp.)* |                          |                                          |                         |                                               |

**Application Directions:** Begin applications of Remote Channel fungicide at pink bud or prior to disease development and continue on a 7- to 14-day interval.

Use the shorter interval when disease pressure is high.

**Resistance Management:** To limit the potential for development of resistance, do not make more than five (5) applications of Remote Channel or other strobilurin (Qol) fungicides per crop.

Do not make more than two (2) sequential applications of Remote Channel before alternating to a labeled non-strobilurin (non-Qol) fungicide with a different mode of action.

For aerial application to Cherry tree crops, use no less than 10 gallons of spray.
## Remote Channel

<table>
<thead>
<tr>
<th>Crop</th>
<th>Target Diseases</th>
<th>Use Rate per Application</th>
<th>Maximum Number of Applications per Season</th>
<th>Maximum Rate per Season</th>
<th>Minimum Time from Application to Harvest (PHI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cucurbit Vegetables Group</strong></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chayote</td>
<td>Downy mildew (Pseudoperonospora cubensis)</td>
<td>8 to 12 oz. per acre</td>
<td>4</td>
<td>64 oz. per acre</td>
<td>0 days</td>
</tr>
<tr>
<td>Chinese waxgourd</td>
<td>Alternaria blight (Alternaria cucumerina)</td>
<td>12 to 16 oz. per acre</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Citron melon</td>
<td>Anthracnose (Colletotrichum orbiculare)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td>Cercospora leaf spot (Cercospora citrulina)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gherkin</td>
<td>Gummy stem blight (Didymella bryoniae)</td>
<td></td>
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</tr>
<tr>
<td>Pumpkin</td>
<td>Microdochium blight (Plectosporium tabacinum)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Watermelon</td>
<td>Powdery mildew (Sphaerotheca fuliginea, Erysiphe cichoracearum)</td>
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<tr>
<td><strong>Edible gourd</strong></td>
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<tr>
<td>Hyotan</td>
<td>Target leaf spot (Corynespora cassicola)</td>
<td></td>
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</tbody>
</table>

**Application Directions:** Begin applications of Remote Channel fungicide prior to disease development and continue on a 7- to 14-day interval. Use the higher rate and the shorter interval when disease pressure is high.

Do not use Remote Channel for control of gummy stem blight where resistance to strobilurin (QoI) fungicides exists.

Do not use Remote Channel tank mixes with additives or adjuvants on muskmelon crops, such as cantaloupe and honeydew, or crop injury may result.

**Resistance Management:** To limit the potential for development of resistance, do not make more than four (4) applications of Remote Channel or other strobilurin (QoI) fungicides per crop.

Do not make more than one (1) application of Remote Channel before alternating to a labeled non-strobilurin (non-QoI) fungicide with a different mode of action.

For additional resistance management information, refer to Section I. General Information, Resistance Management.
Remote Channel

<table>
<thead>
<tr>
<th>Crop</th>
<th>Target Diseases</th>
<th>Use Rate per Application</th>
<th>Maximum Number of Applications per Season</th>
<th>Maximum Rate per Season</th>
<th>Minimum Time from Application to Harvest (PHI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruiting Vegetable Group</td>
<td></td>
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</tr>
<tr>
<td>Eggplant Ground cherry</td>
<td>Anthracnose (Colletotrichum spp.)</td>
<td>8 to 12 oz. per acre</td>
<td>6</td>
<td>96 oz. per acre</td>
<td>0 days</td>
</tr>
<tr>
<td>Pepper (all varieties)</td>
<td>Early blight (Alternaria solani)</td>
<td>or</td>
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</tr>
<tr>
<td>Tomato</td>
<td>Powdery mildew (Leveillula taurica)</td>
<td>8 to 12 oz. per 100 gallons of spray volume (dilute)*</td>
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</tr>
<tr>
<td>Tomato</td>
<td>Septoria leaf spot (Septoria lycopersici)</td>
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</tr>
<tr>
<td>Tomato</td>
<td>Late Blight (Phytophthora infestans)</td>
<td>8 to 16 oz. per acre</td>
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</tr>
</tbody>
</table>

**Application Directions:** Begin applications of Remote Channel fungicide prior to disease development and continue on a 7- to 14-day interval for Anthracnose, early blight, powdery mildew, and Septoria leaf spot. For control of late blight, begin applications prior to disease development, then follow application of Remote Channel with a labeled non-strobilurin (non-Qol) fungicide 5 to 7 days later. Use the higher rate and the shorter interval when disease pressure is high.

*For applications based on dilute volume, plants should be sprayed to runoff. Apply a minimum of 20 gallons of spray volume per acre, and increase the spray volume as the plants grow during the season. Spray volume should be proportional to the amount of plant tissue to be covered such that 100 gallons of spray per acre is used on mature plants.

**Resistance Management:** To limit the potential for development of resistance, do not make more than six (6) applications of Remote Channel or other strobilurin (Q ol) fungicides per crop.
For control of late blight, do not make more than one (1) application of Remote Channel before alternating to a labeled non-strobilurin (non-Qol) fungicide with a different mode of action.
For control of diseases other than late blight, do not make more than two (2) sequential applications of Remote Channel before alternating to a labeled non-strobilurin (non-Qol) fungicide with a different mode of action.
For additional information pertaining to resistance management, refer to **Section I. General Information.**
### Remote Channel

<table>
<thead>
<tr>
<th>Crop</th>
<th>Target Diseases</th>
<th>Use Rate per Application</th>
<th>Maximum Number of Applications per Season</th>
<th>Maximum Rate per Season</th>
<th>Minimum Time from Application to Harvest (PHI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Root Vegetables (except sugar beet)</strong></td>
<td></td>
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<tr>
<td><strong>Subgroup:</strong></td>
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</tr>
<tr>
<td>Carrot</td>
<td>Alternaria leaf spot (Alternaria spp.)</td>
<td>8 to 12 oz. per acre</td>
<td>3</td>
<td>48 oz. per acre</td>
<td>0 days</td>
</tr>
<tr>
<td>Radish (roots and tops)</td>
<td>Cercospora leaf spot (Cercospora spp.)</td>
<td></td>
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<tr>
<td>Garden beet</td>
<td>Powdery mildew (Erysiphe spp.)</td>
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<tr>
<td>Edible burdock</td>
<td>White rust (Albugo spp.)</td>
<td>12 oz. per acre</td>
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<tr>
<td>Celeriac</td>
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<tr>
<td>Chervil (turnip-rooted)</td>
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<tr>
<td>Chicory</td>
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<tr>
<td>Ginseng</td>
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<tr>
<td>Horseradish</td>
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<tr>
<td>Parsley (turnip-rooted)</td>
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<tr>
<td>Parsnip</td>
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<tr>
<td>Oriental radish</td>
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<tr>
<td>Rutabaga</td>
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<tr>
<td>Black salsify</td>
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<tr>
<td>Spanish salsify</td>
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<tr>
<td>Skirret</td>
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<tr>
<td>Turnip</td>
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<tr>
<td><strong>Application Directions:</strong></td>
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<tr>
<td></td>
<td>Begin applications of Remote Channel fungicide prior to disease development and continue on a 7- to 14-day interval. Use the higher rate and the shorter interval when disease pressure is high. Resistance Management: To limit the potential for development of resistance, do not make more than three (3) applications of Remote Channel or other strobilurin (Qol) fungicides per crop. Do not make more than two (2) sequential applications of Remote Channel before alternating to a labeled non-strobilurin (non-Qol) fungicide with a different mode of action.</td>
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</table>

<table>
<thead>
<tr>
<th>Crop</th>
<th>Target Diseases</th>
<th>Use Rate per Application</th>
<th>Maximum Number of Applications per Season</th>
<th>Maximum Rate per Season</th>
<th>Minimum Time from Application to Harvest (PHI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strawberries</strong></td>
<td>Anthracnose (Colletotrichum spp.)</td>
<td>12 to 14 oz. per acre</td>
<td>5</td>
<td>70 oz. per acre</td>
<td>0 days</td>
</tr>
<tr>
<td></td>
<td>Leaf spot (Mycosphaerella fragariae)</td>
<td></td>
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<tr>
<td></td>
<td>Powdery mildew (Sphaerotheca macularis)</td>
<td></td>
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<tr>
<td></td>
<td><strong>Suppression only</strong></td>
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<tr>
<td></td>
<td>Botrytis gray mold (Botrytis cinerea)</td>
<td></td>
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<tr>
<td><strong>Application Directions:</strong></td>
<td>Begin applications of Remote Channel fungicide no later than bloom or prior to disease development and continue on a 7- to 14-day interval. Use the higher rate and the shorter interval when disease pressure is high. Resistance Management: To limit the potential for development of resistance, do not make more than five (5) applications of Remote Channel or other strobilurin (Qol) fungicides per crop. Do not make more than two (2) sequential applications of Remote Channel before alternating to labeled non-strobilurin (non-Qol) fungicide with a different mode of action.</td>
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### Color Pictures: Insect Groups

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<thead>
<tr>
<th>Aphid</th>
<th>Beetle</th>
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<td><img src="Placeholder" alt="Aphid Image" /></td>
<td><img src="Placeholder" alt="Beetle Image" /></td>
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<table>
<thead>
<tr>
<th>Caterpillar</th>
<th>Leafhopper</th>
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<td><img src="Placeholder" alt="Caterpillar Image" /></td>
<td><img src="Placeholder" alt="Leafhopper Image" /></td>
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<table>
<thead>
<tr>
<th>Mite</th>
<th>Scale</th>
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<td><img src="Placeholder" alt="Mite Image" /></td>
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### Color Pictures: Common Weeds

<table>
<thead>
<tr>
<th>Canada Thistle</th>
<th>Chickweed</th>
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</thead>
<tbody>
<tr>
<td><img src="image1" alt="Canada Thistle" /></td>
<td><img src="image2" alt="Chickweed" /></td>
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<table>
<thead>
<tr>
<th>Dandelion</th>
<th>Henbit</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3" alt="Dandelion" /></td>
<td><img src="image4" alt="Henbit" /></td>
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<table>
<thead>
<tr>
<th>Quackgrass</th>
<th>Shepherdspurse</th>
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<tbody>
<tr>
<td><img src="image5" alt="Quackgrass" /></td>
<td><img src="image6" alt="Shepherdspurse" /></td>
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## Color Pictures: Disease Groups

<table>
<thead>
<tr>
<th>Bacterial Leaf Spots</th>
<th>Fungal Leaf Spots</th>
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<tbody>
<tr>
<td><img src="image" alt="Bacterial Leaf Spots" /></td>
<td><img src="image" alt="Fungal Leaf Spots" /></td>
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<table>
<thead>
<tr>
<th>Mildew</th>
<th>Rust</th>
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<tbody>
<tr>
<td><img src="image" alt="Mildew" /></td>
<td><img src="image" alt="Rust" /></td>
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