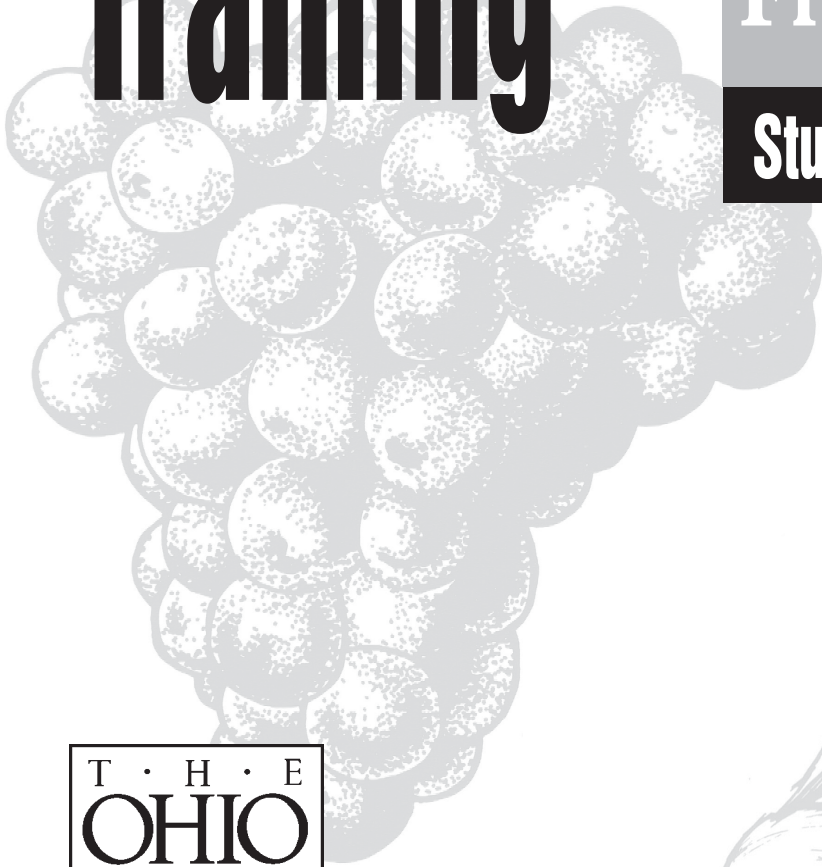


Ohio Pesticide Applicator Training



Fruit Crops

Student Workbook



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Preface

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 the Fruit Crops Category 4. The sample questions presented in this manual will help the reader obtain a general understanding of fruit pest problems, approaches to control, and general information needed to apply and use pesticides safely.

How to Use This Workbook

This workbook is a supplementary study guide to the following bulletins published by Ohio State University Extension. Extension publications are available through county Extension offices.

Bulletin 506-A: Midwest Tree Fruit Handbook

Bulletin 506-A2: Ohio Commercial Tree Fruit Spray Guide

Bulletin 506-B2: Ohio Commercial Small Fruit and Grape Spray Guide

Bulletin 843: The Worker Protection Standard for Agricultural Pesticides—How to Comply

Bulletin 861: Midwest Small Fruit Pest Management Handbook

Ohio State University Extension Fact Sheets

HYG-1425-93 Oil & Other Early-Season Sprays

HYG-2012-92 Spider Mites and Their Control

HYG-2032-94 Peachtree Borer

HYG-2033-94 Lesser Peachtree Borer

HYG-2041-88 Apple Maggot

HYG-2043-88 Plum Curculio

HYG-2047-97 Sap Beetles

HYG-2202-92 White Apple Leafhopper

HYG-2203-92 Codling Moth on Fruit Trees

HYG-2207-94 Rosy Apple Aphid

HYG-3002-94 Fire Blight of Apple and Pear

HYG-3003-94 Scab of Apple and Crabapple

HYG-3004-94 Grape Black Rot

HYG-3009-94 Brown Rot of Stone Fruit

HYG-3014-94 Red Stele Root Rot of Strawberry

HYG-3017-94 Botrytis Fruit Rot "Gray Mold" of Strawberry, Raspberry and Blackberry

HYG-6104-90 How to Use Pesticides Correctly

Additional References

Bulletin 436: Ohio Strawberry Manual

Bulletin 815: Grapes: Production, Management & Marketing

Bulletin IDEA2: Small Fruits Insect & Disease Management

Bulletin IDEA3: Tree Fruits Insect & Disease Management

Bulletin NCR 63: Common Tree Fruit Pests

Read the appropriate sections of these references before attempting to answer questions in the workbook. Use the flap on the back cover to conceal the answers while answering the questions on the left-hand page. Once all the questions for a section are answered, check to see if the responses are correct, mark those incorrect, and read the explanation for each question. If the explanation is confusing or if you disagree with the answer or explanation, refer to the section indicated in the reference.

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Important Topics That Fruit Applicators Should Recognize

Commodities

- Apples
- Brambles
- Grapes
- Peaches
- Strawberries

Apples

- Apple Scab
- Fire Blight
- European Red Mite
- Codling Moth
- Plum Curculio
- San Jose Scale
- Fly Speck and Sooty Blotch

Brambles

- Botrytis Fruit Rot
- Phytophthora
- Cane Blights
- Orange Rusts

Grapes

- Black Rot
- Grape Berry Moth

Peaches

- Brown Rot
- Phytophthora
- Peach Tree Borers
- Oriental Fruit Moth
- Cat-facing insects (Tarnished plant bug, stinkbug)
- Peach Leaf Curl

Strawberries

- Botrytis Fruit Rot
- Red Stele Root Rot
- Leather Rot
- Sap Beetles
- Tarnished Plant Bug
- Verticillium Wilt

Pests of Many Crops

- Japanese Beetle on all crops
- Yellowjackets
- Aphids
- Leafhoppers
- Rodents/Birds

General Concepts

- Integrated Pest Management (IPM)
- Pesticide Resistance Management
- Weed Control Principles
- Protecting bees

With regard to specific chemicals, you will not be held responsible for knowing product names and usage on the exam. However, you should always check the product label for use directions. Questions on the exam focus on general approaches, concerns, etc., and not on specific product recommendations.

Fruit Pesticide Safety and Information

1. All pesticide labels bear the following statement:
 - A. Caution
 - B. Warning
 - C. Keep Out of Reach of Children
 - D. Danger—Poison
 - E. All of the above

2. A pesticide whose label has the signal word “caution” is considered more acutely toxic than one with the signal word “warning.”
 - A. True
 - B. False

3. Highly toxic fruit pesticides contain the following:
 - A. Signal words “Danger—Poison”
 - B. A skull and crossbones
 - C. Both A & B

4. If a fruit pesticide, such as Vydate, has a moderate dermal (or skin) toxicity, it would also have a moderate oral (swallowed) toxicity.
 - A. True
 - B. False

5. If plastic liquid-pesticide containers are triple-rinsed with water when empty, they can be reused.
 - A. True
 - B. False

6. During the restricted entry interval, a 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 protective equipment
 - C. When the smell is gone
 - D. When wearing normal clothing
 - E. After 48 hours

7. The sprayer travel speed can be determined by:
 - A. Measuring the time required to travel a measured distance
 - B. Counting the number of trees passed in 1 minute
 - C. Both A & B

Fruit Pesticide Safety and Information

1. **Correct Answer: C**, Bulletin 506-A

Explanation: All products bear the statement “Keep Out of Reach of Children.” Depending on the toxicity rating, one of the other statements would also appear.

2. **Correct Answer: B**, Bulletin 506-A

Explanation: A pesticide with a low or very low acute toxicity rating has the signal word “Caution” on the label. “Warning” is used on the label of a pesticide considered to have a moderate toxicity rating. The signal words “Danger—Poison” are present on a label of a highly toxic pesticide (the lethal oral dose for a 150-pound man might be as small as a few drops.)

3. **Correct Answer: C**, Bulletin 506-A

Explanation: Highly toxic pesticides that are likely to cause acute illness have the words “Danger—Poison” on the label along with a skull and crossbones. (Products that can cause severe skin or eye irritation will not carry the word “Poison” or the skull-and-crossbones symbol.)

4. **Correct Answer: B**, Bulletin 506-A

Explanation: Several fruit pesticides, including Vydate and Lannate, are considered more dangerous if ingested by swallowing than if absorbed through the skin.

5. **Correct Answer: B**, Bulletin 506-A2, 506-B2

Explanation: Do not reuse pesticide containers. After triple-rinsing, punch holes in metal and plastic containers and crush. Dispose of these and other pesticide containers in accordance with the pesticide label directions as allowed by state and local authorities. ***Ohio has an active program of container recycling. Contact a chemical dealer or Extension agent for collecting sites and times for your area.***

6. **Correct Answer: B**, Bulletin 843

Explanation: The statement concerning reentry is always printed on the label. Under the WPS (Worker Protection Standard) handlers may enter treated areas under the REI to perform handling tasks if they are trained and equipped with PPE. In general, workers must be kept out and information regarding where and for how long the REI is in effect must be communicated to workers. For example, the REI for methyl parathion is 48 hours. WPS allows worker entry into a treated area only in a few narrow work situations. When early entry is permitted under the WPS, special precautions must be given to the early-entry workers, such as protective equipment.

7. **Correct Answer: C**, Bulletin 506-A

Explanation: The following formula can be used to determine travel speed:

$$\text{Speed (MPH)} = \frac{\text{distance (ft)} \times 60 \text{ (sec)}}{\text{time (sec)} \times 88 \text{ (ft)}} \quad (88 = \text{the number of feet traveled in 1 minute at 1 mph})$$

For example, if 60 seconds are required to travel a measured distance of 176 feet, the travel speed is:

$$\text{MPH} = \frac{176 \times 60}{60 \times 88} = \frac{10,560}{5,280} = 2 \text{ MPH}$$

Another method for checking travel speed is to count the number of trees passed in 1 minute.

8. You should always use a spray adjuvant when applying crop protection products.
- A. True
 - B. False
9. As a general rule, one should not spray when temperatures exceed 85 to 90 degrees F.
- A. True
 - B. False
10. A pesticide application with a hand-gun sprayer that covers fruit trees to the point of runoff is referred to as:
- A. A dilute application
 - B. A low-volume application
 - C. A concentrate application
11. A pesticide application with an airblast sprayer that covers fruit trees with fine droplets is referred to as what type of application?
- A. A dilute application
 - B. A low-volume application
 - C. A concentrate application
 - D. Both B & C
12. How can you determine what amount of water is needed for a **dilute** application to a specific block of your apple trees?
- A. Use a chart with tree size and tree spacing.
 - B. Try several volumes with your sprayer in your orchard and see which volume covers to the point of runoff.
 - C. Either of the above
13. If a grower knows it takes 400 gallons of spray mix per acre for a dilute application to his block of big old standard apple trees, and he needs to apply Imidan 70WP insecticide at a dilute rate of 1 pound of product per 100 gallons of water, then how much Imidan 70WP is needed for a dilute spray applied to 1 acre of his big old standard trees?
- A. 1/4 pound
 - B. 4 pounds
 - C. 20 pounds
14. If a grower knows it takes 180 gallons of spray mix per acre for a dilute application to his block of semi-dwarf apple trees, but he is going to use an airblast sprayer that applies 60 gallons per acre with a 3X concentration, then how much Imidan 70WP insecticide will he need to treat 1 acre if the dilute rate is 1 pound of product per 100 gallons of water?
- A. 1/3 pound
 - B. 1.8 pound
 - C. 3 pounds
 - D. 5.4 pounds
15. Failure of pest control may be caused by:
- A. Delaying application until pests are large and numerous
 - B. Making applications with insufficient gallonage and worn nozzles
 - C. Selecting the wrong pesticide
 - D. Repeated use of the same pesticide
 - E. All of the above

8. **Correct Answer: B**

Explanation: It depends on the product used and the crop it is used on. Always read the label.

9. **Correct Answer: A**, Bulletin 506-A

Explanation: At high temperatures, some materials can be harmful to plants. In general, fruit crops are more easily injured by ECS than WPS, especially at high temperatures. Often a product label will warn against spraying at high temperatures.

10. **Correct Answer: A**, Bulletin 506-A

Explanation: Spraying to the point of runoff is the definition of a standard dilute application. Labels of many pesticides used on fruit use the terminology of amount per 100 gallons as the dilute rate, and the amount per acre as the concentrate rate.

11. **Correct Answer: D**, Bulletin 506-A, Bulletin 506-A2

Explanation: Concentrate spraying, also known as low-volume spraying, requires a lower volume of water per acre and a proportional increase in the concentration of pesticide in the water.

12. **Correct Answer: C**, Bulletin 506-A

Explanation: Trees of different ages and cultivars have different canopy sizes and thus require different volumes of water to adequately cover them. Pesticide application is most effective and efficient if you know how much water is actually required for your trees using your spray equipment. If you know the distance between rows, tree width, and tree height, then Table 3 shows the maximum dilute spray needed. Testing several volumes in your orchard and comparing the results can also be done, and may be a bit more accurate for specific varieties and canopy densities.

13. **Correct Answer: B**, Bulletin 506-A

Explanation: If he needs 1 lb product per 100 gallons of water and he needs 400 gallons to spray one acre, then he needs $1 \text{ lb} \times 4 = 4 \text{ lbs}$ for 400 gallons of water.

14. **Correct Answer: B**, Bulletin 506-A

Explanation: The amount of pesticide per acre is the dilute rate (amount of product per 100 gallons), multiplied by his concentrate volume per acre, multiplied by his concentration factor. In this case, $(1 \text{ lb}/100 \text{ gal}) \times (60 \text{ gal/acre}) \times 3 = 180/100 = 1.8 \text{ lbs/acre}$. A key point to keep in mind is that with both concentrate and dilute applications, you want to achieve the *correct rate per acre*. In converting from one to the other, the gallons per acre of spray mixture changes and the concentration of the pesticide in the tank changes, but the actual rate of pesticide applied to an acre stays the same.

15. **Correct Answer: E**, Bulletin 506-A

Explanation: Pest control measures may fail for several reasons, including all of those listed.

16. Effective pest control can be achieved by:
- A. Inspecting fields regularly for pest buildup
 - B. Providing adequate coverage of plants
 - C. Selecting the proper crop protection product
 - D. Keeping the sprayer in proper working condition by calibrating and replacing worn nozzles
 - E. All of the above
17. Pesticide resistance can be reduced by:
- A. Occasionally changing to a material of another chemical class
 - B. Using more of the chemical the first time to take out all the insects
 - C. Spraying as soon as some of the insects are observed in the field
 - D. All of the above
18. Some pyrethroid insecticides may be less effective when:
- A. Applied by an air-blast sprayer
 - B. The air is calm
 - C. Temperatures during and after application are above 85 degrees F
 - D. None of the above
19. If the desired tractor speed for proper application is 4 mph, then slowing down at row ends to 2 mph means the rate of application will be:
- A. Double the normal rate
 - B. Half the normal rate
20. Pesticide drift must be controlled because:
- A. It can damage nearby plants
 - B. It can cause illegal residues on nearby crops
 - C. It can land on workers or other people
 - D. It can result in financial damage responsibilities for the grower and applicator
 - E. All the above
21. Pesticides that are not compatible when mixed together can cause:
- A. Loss of effectiveness against the target pest
 - B. Injury or damage to the treated area
 - C. Separation of ingredients or settling out
 - D. All of the above
22. When using pesticides for agricultural plant uses, fruit growers with one or more workers will have to comply with the following generic provisions of the WPS:
- A. Pesticide safety training
 - B. Decontamination sites
 - C. Emergency assistance
 - D. Central information posting
 - E. All of the above
23. On farms, any worker who might enter a treated area or walk within 1/4 mile of a treated area during application must be warned by:
- A. Oral notification of locations and description of treated area and/or posted warning signs
 - B. Oral notification of pesticide used
 - C. Oral notification of pest in treated areas
 - D. A & B
 - E. A & C

16. **Correct Answer: E**, Bulletin 506-A

Explanation: Following these rules greatly increases the chances of effective pest control.

17. **Correct Answer: A**

Explanation: Do not depend on one material to do the job, no matter how effective it is. Change to a material of another chemical class occasionally (monthly, for example). This may help reduce the development of pesticide resistance. Using the material only when needed and at the right rate will also reduce the potential for resistance. This practice is environmentally sound and will help preserve pesticide tools for the future. New pesticide development has slowed during the past several years.

18. **Correct Answer: C**

Explanation: Pay attention to temperature when using pyrethroids. Some may be less effective if temperatures during and after application are above 85 degrees F.

19. **Correct Answer: A**

Explanation: If tractor speed is reduced by a factor of 50%, the chemical rate of application is doubled because it takes twice as long to cover the same distance or area.

20. **Correct Answer: E**

Explanation: Drift is the number one complaint to the Ohio Department of Agriculture and may result in any one of the above adverse effects. Fines and penalties may result. Often damage from drift or off target movement by volatile materials is apparent long distances from the site of application. Special care needs to be taken to assure the safety of sensitive nontarget plants. Most problems arise from spraying when windy, with high pressure, with a volatile material and at high temperatures.

21. **Correct Answer: D**

Explanation: Sometimes different pesticides can be mixed together to control a wider range of pests with a single application. Labels may list other pesticides that are compatible. Be careful with do-it-yourself mixes. You should do a jar test to make sure mixes are compatible and spray a small area of the field to see if the mixture will cause crop damage.

22. **Correct Answer: E**, Bulletin 843

Explanation: A farm establishment with one or more employees who perform tasks related to the cultivation and harvesting of plants must comply with all the generic provisions of WPS, if the workers will be in an area which has been treated with pesticides within the last 30 days.

23. **Correct Answer: A**, Bulletin 843

Explanation: Farm owners and operators with one or more employees are required to comply with the generic provisions of the WPS. Among these provisions is the requirement to give either oral or written notification to workers who might enter or walk within 1/4 mile of a treated area. The oral warning must include the location and description of the treated area, time of REI, and instructions not to enter the treated area. A posted warning sign with certain requirements for site, color, wording, information, and posting site may also be used to warn farm workers of treated areas.

24. Licensed applicators should maintain accurate spray records that show:
- A. Application rates
 - B. Name of the pesticide used
 - C. Total gallonage
 - D. Weather data
 - E. All of the above
25. Which of the following should be consulted to determine the necessary protective equipment to be used by pesticide applicators?
- A. Pesticide dealer
 - B. Pesticide label
 - C. Extension Service
 - D. Ohio Department of Agriculture
 - E. All of the above
26. Days to harvest restrictions (preharvest intervals [PHI]) are the same as Restricted-Entry Intervals (REI).
- A. True
 - B. False
27. Sprayers used for herbicide applications are acceptable for use with both insecticide and fungicide applications for fruit crops.
- A. True
 - B. False
28. Clothing that has become completely saturated with a highly toxic or highly concentrated pesticide should be discarded rather than washed and reused.
- A. True
 - B. False
29. The first step in using a pesticide correctly is to identify the pesticides available for control of the fruit pest.
- A. True
 - B. False

24. **Correct Answer: E**, Bulletin 506-A2, Bulletin 506-B2

Explanation: Private applicators are required by law to keep records of all applications of RUP's for 3 years. Be prepared to show your records to the USDA or Department of Agriculture inspectors if necessary. It is important to maintain accurate spray records of all pesticides to document pesticide use but also to aid in making sound management decisions. Items you must record are:

1. Certified applicator (name, address, certification number);
2. The brand or product name, formulation, and EPA registration number of the restricted-use pesticide applied;
3. The total amount and the rate of application of the restricted-use pesticide applied;
4. Location and/or field number for area treated and total area or acreage treated;
5. Crop treated;
6. Target pest;
7. Month, day, and year of applications;
8. Type of application equipment;
9. Method of application (preemergence, postemergence, planter, foliar, etc.);
10. Weather conditions including air temperature, wind speed and direction when pesticides are applied outside of a structure.

25. **Correct Answer: B**, Bulletin 506-A2, Bulletin 506-B2

Explanation: Use an adequate respirator and protective clothing, especially when mixing pesticides. The necessary protective equipment is listed on the pesticide label.

26. **Correct Answer: B**, Bulletin 506-A2, Bulletin 843

Explanation: The length of the REI and PHI may be different because they are designed for different purposes. REI regulations are to protect handlers and workers from long-term repeated exposures to agricultural pesticides. PHI's are intended to reduce or eliminate pesticide residues on harvested fruit. A person harvesting fruit, if they are not considered either a handler or a worker, may need only to observe the PHI before picking fruit. An example would be a "pick-your-own" operation where the general public would not have long-term exposure to agricultural pesticides because they have infrequent contact with residues. Check labels carefully for wording of REI's for agricultural uses involving workers and those for the general public or nonagricultural uses.

27. **Correct Answer: B**, Bulletin 506-A2

Explanation: It is suggested that a separate boom sprayer be maintained for herbicide applications to prevent crop injury. Field sprayers are seldom adequate for thorough spray coverage on fruit crops.

28. **Correct Answer: A**

Explanation: Researchers recommend that you discard (burn or bury) clothing completely saturated with a highly toxic or highly concentrated pesticide. Clothing contaminated with moderate- or low-toxicity products can be washed separately from the family wash.

29. **Correct Answer: B**, HYG-6104-90

Explanation: The first step in using a pesticide correctly is to identify the pest. Because pesticide products can be very specific in their pest-control spectrum, it is vital to identify the pest correctly.

30. Which of the following are components of an IPM program?
- A. Selecting insecticides not highly toxic to natural enemies
 - B. Scouting for pests such as mites
 - C. Trapping for the adult stage of pests such as codling moth
 - D. Tolerating a low level infestation of some pests
 - E. All of the above
31. The use of Integrated Pest Management (IPM) programs in apple production can *reduce* the use of pesticides.
- A. True
 - B. False
32. Preharvest intervals can be shortened to allow for harvesting a crop threatened by adverse weather conditions.
- A. True
 - B. False

Fruit Insect, Mite, and Wildlife Control

33. Tiny brown trails throughout the flesh of an apple are caused by:
- A. Plum curculio
 - B. Apple maggot
 - C. Spotted tentiform leafminer
 - D. Codling moth
34. You observe a crescent-shaped mark on the skin of an apple. The damage was most likely caused by:
- A. Apple maggot
 - B. Spotted tentiform leafminer
 - C. San Jose scale
 - D. Plum curculio
35. You observe curling and deposits of honeydew on an apple. The insect or mite most likely responsible is:
- A. European red mite
 - B. Aphids
 - C. White apple leafhopper
 - D. Red-banded leafroller
36. You observe chewed material, or excrement, called “frass” around a hole on an apple. The damage was most likely caused by:
- A. Apple maggot
 - B. Green fruitworm
 - C. Spotted tentiform leafminer
 - D. San Jose scale
 - E. Codling moth
37. At harvest time, you note apple fruit with a red spotted or mottled appearance. This damage was most likely caused by:
- A. European red mite
 - B. San Jose scale
 - C. Rosy apple aphid
 - D. White apple leafhopper

30. **Correct Answer: E**

Explanation: Integrated pest management (IPM) includes all four activities listed. IPM growers do not apply insecticides on a strict calendar schedule, but they monitor pests in their plantings and apply insecticides when pests are found at critical levels. IPM includes biological, chemical, cultural, and mechanical controls.

31. **Correct Answer: A**, Bulletin 506-A

Explanation: The development and implementation of IPM programs for apple production has great potential for improving current pest control strategies by altering the timing of treatments and choice of pesticide but may not always reduce the number of treatments.

32. **Correct Answer: B**, Bulletin 506-A

Explanation: Pesticides are registered by the EPA, and can legally be used only as indicated on the individual labels. The legal limitations in the use of these pesticides should be strictly observed to prevent excessive residues in or on harvested fruit. This means that preharvest intervals must be observed.

Fruit Insect, Mite, and Wildlife Control

33. **Correct Answer: B**, Bulletin 506-A

Explanation: Adult apple maggot flies puncture the skin of an apple and insert an egg into it. The eggs hatch into legless maggots that feed by tunneling throughout the apple flesh, and leave tiny brown trails.

34. **Correct Answer: D**, Bulletin 506-A

Explanation: Plum curculio attack a number of fruit species, including apple, peach, plum, cherry, pear, apricot, and others. Eggs are laid on crescent-shaped flaps cut in skin of young fruit.

35. **Correct Answer: B**, Bulletin 506-A

Explanation: The presence of rosy apple aphid should be checked before the spray at the “pink” growth stage of apples. Green apple aphid may build up in June; treat when numerous, but before excessive terminal leaf curling and honeydew deposits are observed.

36. **Correct Answer: E**, HYG-2203-92

Explanation: As the larva of the codling moth feeds on an apple, it pushes out a mass of chewed material, or excrement, called “frass.” This frass accumulates around the entrance hole made by the larva.

37. **Correct Answer: B**, HYG-2039-92, HYG-2202-92, Bulletin 506-A

Explanation: The red spotted or mottled appearance was likely caused by feeding of San Jose scale. Infested fruit has a spotted or mottled appearance because of a small red inflamed area surrounding each scale. Although three of these pests (European Red Mite, Aphids, and Leafhopper) are considered to be indirect pests (primarily foliage feeders), sometimes they can also cause fruit damage.

38. Petal-fall and first cover are two of the most critical times for controlling key apple pests such as:
- A. Apple maggot
 - B. Plum curculio
 - C. Codling moth
 - D. All of the above
 - E. B & C
39. At petal-fall, you find white apple leafhoppers in your orchard. Which of the following are products most appropriate for their control?
- A. Provado or Carzol
 - B. Sevin or Vydate
 - C. Imidan or Guthion
40. The primary targets of summer cover sprays are:
- A. Apple maggot
 - B. Plum curculio
 - C. Codling moth
 - D. All of the above
 - E. A & C
41. All miticides are highly toxic to beneficial (predatory) mites.
- A. True
 - B. False
42. Which of the following is one of the best *early-season* control agents for mites?
- A. Pyramite
 - B. Carzol
 - C. Superior oil
 - D. Vydate
43. For mite control, superior oil is applied at higher rates (2%) for dormant applications, but at lower rates (1%) for delayed-dormant applications.
- A. True
 - B. False
44. To avoid phytotoxicity, oil should *not* be applied to apple trees at half-inch green if:
- A. The overnight low temperature will be 60 degrees
 - B. The overnight low temperature will be 35 degrees
 - C. The moon is full
45. A delayed oil spray at half-inch green stage of growth of apples will help control:
- A. San Jose scale
 - B. European red mite
 - C. A & B

38. **Correct Answer: E**, Bulletin 506-A
Explanation: Apple maggot is not active until midsummer, but both plum curculio adults and codling moth larvae become active around petal-fall (late April to mid-May). Petal-fall is usually the best time to control plum curculio. Insecticide spray at petal-fall also controls the earliest larvae of codling moth. Most of the codling moth larvae are killed by an insecticide spray at first cover (10 to 14 days after petal-fall).
39. **Correct Answer: A**, Bulletin 506-A, HYG-2202-92
Explanation: While all of these products are labeled for apples, some are preferred over the others. Provado and Carzol are the most effective insecticides for white apple leafhopper (WALH) control. WALH has become resistant to commonly used cover spray insecticides, such as Guthion and Imidan. Sevin and Vydate are very effective, but will cause fruit thinning if used within 30 days of bloom.
40. **Correct Answer: E**, Bulletin 506-A2
Explanation: Plum curculio is usually an early-season pest that is no longer active during the summer. Codling moth is a pest throughout the year, usually with one peak of activity in late May and another in July. Apple maggot is active in July and August.
41. **Correct Answer: B**, Bulletin 506-A
Explanation: Miticides vary in their toxicity to beneficial mites. Savey and Apollo are effective products that are less harmful to beneficial mites than other miticides. Remember that these products are rate dependent—higher rates are more harmful.
42. **Correct Answer: C**, Bulletin 506-A
Explanation: Over the years, an application of superior oil made close to the time mites hatch (from half-inch green to tight cluster) has proven to be one of the best control agents. The oil coats the eggshell, thereby suffocating the developing mite. Thorough coverage is very important to get adequate suffocation. Because the mode of action is physical not chemical, it is not likely that mites will develop resistance to oil.
43. **Correct Answer: A**
Explanation: Oil kills mites by suffocating the eggs so that they will not hatch. Eggs are less susceptible to oil when they are still dormant, but they become more susceptible to oil as they get closer to hatching. Mite eggs begin to hatch when buds are at about the pink bud stage. So they are most susceptible to oil at the tight duster stage. Rates can thus be lowered once buds begin to open. Certain oil products are labeled for use during the summer at low rates (0.5% to 1%).
44. **Correct Answer: B**, Bulletin 506-A2
Explanation: Phytotoxicity will occur if temperatures are near freezing within 24 hours, either before or after application.
45. **Correct Answer: C**, Bulletin 506-A, Bulletin 506-A2
Explanation: Superior oil (70 sec. viscosity) is useful in the control of both San Jose scale and European red mite eggs.

46. Pheromone traps are useful for monitoring:
- A. Peachtree borer in peaches
 - B. Codling moth in apples
 - C. San Jose scale in apples
 - D. Oriental fruit moth in peaches
 - E. All of the above
47. Gummosis on trunks and limbs of peaches can be caused by several unrelated factors. Which of the following pests can be a problem of peaches?
- A. Shothole borer
 - B. Lesser peachtree borer
 - C. Peachtree borer
 - D. All of the above
48. The best time to apply an insecticide to a peach tree trunk to control peachtree borer can be determined by:
- A. Calendar schedule
 - B. Pheromone traps
 - C. The presence of gummosis
49. Japanese beetle is a serious pest on both grapes and brambles.
- A. True
 - B. False
50. Grape berry moth can be controlled by insecticides applied at what time(s) of year?
- A. Prebloom for 1st generation larvae (June)
 - B. 2nd generation larvae in August
 - C. A & B
51. Which of the following pests causes deformed “button-berries” on strawberries and brambles?
- A. Strawberry weevil
 - B. Sap beetle
 - C. Meadow spittlebug
 - D. Tarnished plant bug
52. You find a number of damaged and dead trees in your apple orchard during springtime. The trees seem to have been girdled by bark removal near or at the soil line. What damaged your trees?
- A. Mice
 - B. Deer
 - C. Ground hogs
 - D. Graft incompatibility
53. Which of the following allows growers to control deer in orchards?
- A. Repellents
 - B. Fencing
 - C. Controlled hunting
 - D. All of the above
 - E. A & C

46. **Correct Answer: E**, Bulletin 506-A2 (all 4 pests), HYG-2203-92 (codling moth), HYG-2039-92 (San Jose scale), HYG-2032-94 (peachtree borer)
Explanation: A trap baited with a pheromone (sex-attractant) lure can be used to determine exactly when the adult males of any of these pests begin emerging, as well as when there is a peak of activity, and when their activity period ends. Monitoring of adults is done to estimate the best time for control of larvae before the larvae damage the fruit trees. ***Trapping in more than one orchard block for several years allows growers to detect differences in pest abundance from year to year or from block to block.*** Although lures are available for additional fruit pests, the four pests listed here are the best four to monitor with pheromone traps because we have rules available on how to manage the pest based on information from trapping.
47. **Correct Answer: D**, Bulletin 506-A2
Explanation: The peachtree borer at the base of the tree, lesser peachtree borer in scaffold branches and shothole borer often infest peach trees. They also can infest apricot, cherry, and plum trees.
48. **Correct Answer: B**, Bulletin 506-A2
Explanation: Control of peachtree borer is mostly preventive, so you need to control young larvae before they enter the tree. You can judge when eggs will hatch by monitoring when adults appear in pheromone traps.
49. **Correct Answer: A**, Bulletin 506-B2
Explanation: Japanese beetle adults include raspberries, blackberries, and grapes among their favorite foods. Some differences in cultivar resistance can be expected. If Japanese beetles are a problem in your area, expect to scout for beetle damage.
50. **Correct Answer: C**, Bulletin 861, Bulletin 506-B2
Explanation: Good control of first generation larvae prebloom (in June) helps prevent a large second generation of larvae in August. It is the feeding by larvae in August that is most harmful to the grape crop.
51. **Correct Answer: D**, Bulletin 861
Explanation: The tarnished plant bug feeds on flowers and early stages of fruit, causing abnormal growth.
52. **Correct Answer: A**, Bulletin 506-A2
53. **Correct Answer: D**, Bulletin 506-A
Explanation: Repellents can provide some relief from deer damage, although it is usually temporary. Eight-foot deer fences are effective, but impractical because of their expense. Electric fence in several configurations is reasonably successful. Controlled hunting has been relatively effective in reducing populations over a period of years.

54. Insecticides should *not* be applied during bloom.
- A. True
 - B. False
55. Birds can be serious pests in blueberries, grapes, and cherries. Strategies to reduce bird damage include:
- A. Netting
 - B. Mesurol
 - C. Noise and scare devices
 - D. Toxic bait
 - E. A & C
56. Rotation of several classes of miticides from year to year is desirable in delaying the development of mite resistance to pesticides.
- A. True
 - B. False
57. Excessive use of Benlate and/or Topsin-M may cause increased injury from mites due to the adverse effects of these fungicides on predator mites.
- A. True
 - B. False
58. The use of pyrethroids (Ambush, Pounce, Asana) at petal-fall for control of plum curculio, redbanded leafroller, and codling moth is recommended.
- A. True
 - B. False
59. The best way to manage yellowjackets and other wasps in fruit crops is:
- A. Spray insecticide immediately before the first harvest
 - B. Practice good sanitation

Fruit Disease Control

60. Brown rot is a disease of which of the following fruit?
- A. Apples
 - B. Plums
 - C. Peaches
 - D. Cherries
 - E. All of the above
 - F. B, C & D
61. Unlike most fruit insecticides and miticides, commonly used fungicides have no preharvest restrictions.
- A. True
 - B. False
62. Apple scab fungus will infect:
- A. Leaves
 - B. Fruit
 - C. Bark
 - D. Roots
 - E. Both A & B

54. **Correct Answer: A**, Bulletin 506-A2
Explanation: Bees may come into contact with insecticides as they are pollinating flowers. Save the bees. Do not spray insecticides during bloom.
55. **Correct Answer: E**
Explanation: Toxic baits are illegal for songbirds, which are usually the problem. Noise makers, scare devices, and netting can be useful for a period for controlling bird damage, but a variety of strategies are usually required to maintain control.
56. **Correct Answer: A**, HYG-2012-92
Explanation: European red mite has a history of developing resistance to miticides. Rotation is a good way to delay resistance. It is best to rotate among three early season strategies:
Year 1: Apollo or Savey
Year 2: Agri Mek
Year 3: oil (delayed dormant)
57. **Correct Answer: A**, Bulletin 506-A2
Explanation: Benlate and Topsin-M are the fungicides of choice for prevention of sooty blotch and flyspeck; however, excessive use of Benlate and/or Topsin-M may result in the buildup of resistant strains of the apple scab fungus and/or increased mite injury due to the adverse effect of these fungicides on predator mites.
58. **Correct Answer: B**, Bulletin 506-A2
Explanation: Use of pyrethroids (Ambush, Pounce, Asana) is likely to cause mite outbreaks because they kill mite predators and persist a long time.
59. **Correct Answer: B**, Bulletin 506-A2
Explanation: It is impractical and ineffective to use insecticides to control wasps, which are attracted to sweet juices in ripe, overripe, and injured fruit. Sanitation means promptly and thoroughly removing all fruit as soon as it is ripe. Injured fruit should be removed and discarded.

Fruit Disease Control

60. **Correct Answer: F**, Bulletin 506-A
Explanation: Brown rot caused by the fungi *Monilinia fructicola* and *Monilinia laxa*, is the most destructive disease of stone fruits (peaches, nectarines, plums, prunes, cherries, and apricots) in the Midwest.
61. **Correct Answer: B**, Bulletin 506-A2, Bulletin 506-B2
Explanation: Many fruit fungicides have harvest restrictions. In addition, the number of applications per season or the total amount of fungicide applied may be limited by the label.
62. **Correct Answer: E**, HYG-3003-94

63. The repeated use of Benlate or Topsin-M alone can cause a buildup of fungicide resistant strains of the apple scab fungus.
- A. True
 - B. False
64. When using protectant fungicides to control apple scab, it is necessary to apply the fungicide before infection takes place.
- A. True
 - B. False
65. The use of disease-resistant apple cultivars can reduce the need for early-season fungicide applications.
- A. True
 - B. False
66. One of the key factors in the severity of apple scab is cool, wet weather during spring.
- A. True
 - B. False
67. A delayed-dormant application of liquid lime sulfur is important for control of anthracnose in raspberries and blackberries.
- A. True
 - B. False
68. Phytophthora root rot is a serious disease of red and purple raspberries. Suppression of this disease can be accomplished by which of the following?
- A. Planting on raised bed to improve soil drainage
 - B. Proper fertilization
 - C. Use of Ridomil
 - D. Plant in wet areas
 - E. Both A & C
69. Fungicides are important in strawberries to prevent Botrytis fruit rot (gray mold). The best time to make fungicide applications to control this disease is:
- A. During bloom
 - B. When growth starts in early spring
 - C. During harvest
 - D. Postharvest
70. The most serious and common fruit rot disease on brambles is:
- A. Orange rust
 - B. Anthracnose
 - C. Botrytis gray mold

63. **Correct Answer: A**, Bulletin 506-A2, Bulletin 861
Explanation: Benlate and Topsin-M have the same mode of action and should be used in combination with or alternated with fungicides that have a different mode of action in order to prevent the buildup of resistant strains of the apple scab fungus. Similarly, Nova and Rubigan are at risk for the development of resistance. Growers should consider using these fungicides (at the full labeled rate) in combination with or alternated with other, nonrelated fungicides.
64. **Correct Answer: A**, Bulletin 506-A, Bulletin 506-A2
Explanation: Protectant fungicides have no systemic activity. Thus, they act as a protective barrier on plant surfaces and must be applied before the fungus enters the plant. Some fungicides such as the sterol inhibiting fungicides (Rubigan, Nova, Bayleton) have locally systemic activity and can penetrate into plant tissues. These fungicides have “curative” activity and can stop further development of infections if they are applied within 3 to 4 days (72 to 96 hours) after the initiation of the infection period. True “eradicant” fungicides eliminate the fungus from established lesions. We currently do not have good eradicant fungicides for control of fruit diseases. Thus, it is critical to apply fungicides before symptoms (lesions) develop. *Note: Sometimes the term “eradicant” is used incorrectly in the trade for the term “curative.” As a result, on the exam, both of these terms may be used to describe products with locally systemic or “kick-back” activity.*
65. **Correct Answer: A**, HYG-3003-94
Explanation: The use of scab-resistant or “immune” cultivars greatly reduces the need for early-season apple scab fungicide use. In fact, by using a cultivar such as “Liberty” that has resistance to scab, mildew, and rusts, the need for early-season fungicide application is essentially eliminated.
66. **Correct Answer: A**, Bulletin 506-A
Explanation: The fungus that causes apple scab requires free water on the surface of the plant before its spores can germinate and cause infection. Thus, scab is most severe when frequent rainfalls occur in spring. However, fungicide applications are generally still required for scab control during “drier” seasons in Ohio.
67. **Correct Answer: A**, Bulletin 506-B2, Bulletin 861
Explanation: A delayed-dormant (1/4 inch green, new growth) application of liquid lime sulfur aids in “burning out” or eradicating overwintering inoculum of anthracnose in cane lesions. *Note: Ohio does have a 24c for Captan on brambles.*
68. **Correct Answer: E**, Bulletin 506-B2, Bulletin 861
Explanation: The systemic fungicide Ridomil has proven to be effective in suppressing Phytophthora root rot. Planting on raised beds will also improve the soil drainage which is an important cultural practice for controlling the disease.
69. **Correct Answer: A**, Bulletin 506-B2, Bulletin 861
Explanation: Research has shown that the most critical time for control of Botrytis is during bloom. Little benefit is derived from fungicides applied during harvest.
70. **Correct Answer: C**, Bulletin 861
Explanation: Many fungi are capable of rotting mature or near-mature fruits of raspberries and blackberries under favorable environmental conditions. The most serious and common fruit rot disease worldwide is gray mold. Gray mold is caused by the fungus *Botrytis cinerea*.

71. Which of the following diseases can be controlled by selecting disease-resistant cultivars of strawberries?
- A. Red stele
 - B. Verticillium wilt
 - C. Leaf spot
 - D. Leaf scorch
 - E. Powdery mildew
 - F. All of the above
72. Do not plant Verticillium-susceptible strawberry cultivars in soil where which of the following crops have been grown in the last five years?
- A. Tomato
 - B. Pepper
 - C. Potato
 - D. Eggplant
 - E. Brambles
 - F. All of the above
73. Fire blight of apples and pears can be reduced by which of the following?
- A. Use of less-susceptible cultivars
 - B. Use of fungicides
 - C. Use of streptomycin
 - D. Increase nitrogen fertilization
 - E. A & C
74. Mummified fruit (Mummies) are important for overwinter survival of the fungi that cause which of the following diseases?
- A. Brown rot of stone fruit
 - B. Red stele root rot of strawberry
 - C. Black rot of grape
 - D. Mummy berry of blueberry
 - E. A, C & D
75. The use of resistant cultivars is the most economical and effective means of controlling red stele.
- A. True
 - B. False
76. Black rot can be an important economic disease to both table and juice grapes. How does the disease spread each spring?
- A. Spores blown in from Kentucky on southwest winds
 - B. Aphid feeding
 - C. Overwintering spores on canes and mummified fruit that are splashed to new growth by rainwater
 - D. Research has not pinpointed the life cycle
77. Controlling cane diseases in bramble crops is important for success in commercial plantings. The best control for preventing cane diseases is:
- A. Dormant applications of liquid lime-sulfur
 - B. Proper pruning and prompt removal of spent canes
 - C. Maintaining proper row width
 - D. All of the above

71. **Correct Answer: F**, Bulletin 506-B2, Bulletin 861

Explanation: Strawberry cultivars commonly grown in the Midwest show varying degrees of resistance to red stele, verticillium wilt, leaf spot, leaf scorch, and powdery mildew. Resistant characteristics of the cultivar usually preclude the need for other controls.

72. **Correct Answer: F**, Bulletin 436

Explanation: All of these crops plus melons, okra, stone fruits, chrysanthemums, rose, or related crops are susceptible to Verticillium wilt.

73. **Correct Answer: E**, HYG-3002-94

Explanation: Fire blight is caused by a bacterium, so an antibiotic such as streptomycin can reduce fire blight damage. (Fungicides generally control fungus pests, not bacteria.) The use of apple and pear cultivars that are less susceptible to fire blight will help as part of an integrated control program. Increasing nitrogen fertilization may encourage tender new growth that is susceptible to bacterial infection. Pruning out fire blight cankers and blighted twigs is also recommended.

74. **Correct Answer: E**, HYG-3004-94, HYG-3009-94

Explanation: Mummy berry of blueberry is caused by a fungus causing the fruit to shrivel into “mummies.” Mummified grape berries are symptoms of another fungus disease—grape black rot. Peaches will also rot rapidly and shrink into dry wrinkled mummies from Brown rot infection. Proper sanitation such as removal of mummies is an extremely important part of the disease control program for all these diseases.

75. **Correct Answer: A**, Bulletin 436

Explanation: Red stele is a soil-borne disease that is more prevalent on heavy, poorly drained soils. This fungus is difficult to control with either fumigation or fungicides on heavy soils. Although Ridomil is currently labeled, excellent resistant cultivars offer the best choice for control. Rotation and using disease free plants will also help reduce disease. Improving soil drainage or planting in raised beds will also help.

76. **Correct Answer: C**, Bulletin 815, Bulletin 861, HYG-3004-94

Explanation: Black rot is spread from overwintering spores by splashing rainwater. The spores overwinter on old canes and fruit mummies from the previous year. It first infects the young leaves and then the developing fruit. Thorough coverage of fungicides beginning soon after shoot growth is important.

77. **Correct Answer: D**, Bulletin 783, Bulletin 861

Explanation: All of the cultural and fungicide options will assist in controlling cane diseases.

Fruit Weed Control

78. Gramoxone Super (paraquat) is an effective postemergent herbicide in some fruit crops. Which of the following is *not* true of Gramoxone Super?
- A. It is nonselective
 - B. It is safe for contact with skin
 - C. It has no residual action
 - D. It will injure foliage of the fruit crop
79. Because paraquat (Gramoxone Extra or Gramoxone Super) is a nonselective herbicide, it is not used around tree fruit or small-fruit crops.
- A. True
 - B. False
80. The timing of applications of Roundup (glyphosate) for weed control in tree fruit and grapes depends on the growth stage of the targeted pest.
- A. True
 - B. False
81. In addition to improving plant growth by reducing competition, herbicides may aid in controlling pests and rodents.
- A. True
 - B. False
82. A handgun on a weed sprayer is useful for the application of residual herbicides under trees or around fruit plants.
- A. True
 - B. False
83. Preemergence herbicides:
- A. Are effective on germinating seeds and young seedling plants
 - B. May have restrictions on use in new tree plantings
 - C. May be affected by soil type
 - D. All of the above
84. Perennial weeds around fruit trees can be sprayed anytime in the harvest year that those weeds are actively growing as long as the preharvest interval is observed.
- A. True
 - B. False
85. Mixing of certain herbicides can be beneficial.
- A. True
 - B. False

Fruit Weed Control

78. **Correct Answer: B**, Bulletin 506-A

Explanation: Gramoxone is a highly toxic herbicide that requires special precautions to prevent inhalation or contact with skin.

79. **Correct Answer: B**, Bulletin 506-A, Bulletin 506-A2, Bulletin 506-B2

Explanation: Gramoxone Extra, when used as a directed spray, is labeled for use in apples, blueberries, cherries, grapes, peaches, pears, plums, and strawberries for control of most emerged annual weeds and top-kill of perennial weeds.

80. **Correct Answer: A**, Bulletin 506-A, Bulletin 506-A2, Bulletin 506-B2

Explanation: Roundup is foliar-applied and translocates downward to the root system. For this reason, it is best applied when weeds are actively growing and translocating carbohydrates downward. Be careful not to contact suckers or green tissue of desirable plants or damage may result. Often the damage from Roundup to trees does not show up until the following year.

81. **Correct Answer: A**, Bulletin 506-A2, Bulletin 506-B2

Explanation: Herbicides are very useful in tree and small-fruit plantings, substantially reducing labor costs. When herbicides are used properly, plant growth may be superior and the control over mice and rodents may be enhanced.

82. **Correct Answer: B**, Bulletin 506-A2, Bulletin 506-B2

Explanation: A fixed boom-type sprayer, when properly designed, will deposit herbicide uniformly. Do not use handguns to apply residual herbicides around fruit plants. Handguns are useful only for spot treatment with materials like Gramoxone Super or Roundup. Be careful over exposed tree or grape vine roots.

83. **Correct Answer: D**, Bulletin 506-A

Explanation: Preemergence herbicides are effective in controlling germinating seeds and young seedling plants. It is important to pay close attention to label restrictions. For example, some preemergents can be used on newly planted orchards. Others can be used only on established trees or vineyards. Some preemergent herbicides specify lower rates for sandy soils *or with low organic matter*.

84. **Correct Answer: B**, Bulletin 506-A2

Explanation: When using glyphosate, the weeds should be in the bud stage but still actively growing. Application too early is not as effective in killing perennial weeds. Perennial weeds are best controlled by using a combination of properly-timed applications and mowing.

85. **Correct Answer: A**, Bulletin 506-A2

Explanation: Certain herbicides can be tank mixed with other herbicides to increase the spectrum of weed species controlled and to increase the effectiveness of herbicide materials. Consult herbicide labels for specific information on tank mixes. Mixing of herbicides or rotating herbicides with different modes of action can also help prevent development of resistant weed populations.

Fruit Crop Pest Control Score Card

No. of Questions Answered Correctly	% Correct	Evaluation
77–85	> 90%	Excellent —You have a very good understanding of fruit pests and their control.
68–76	> 80%	Good —Be sure you understand those questions you missed. It may help to read the references again and reanswer the questions you missed.
59–67	> 70%	Needs Improvement —Your score indicates a borderline level of expertise. Be sure to read the cited references again and reanswer the questions you missed.
0–58	< 70%	Reread the recommended references and work through the workbook again.

Your comments and suggestions to improve this study tool for future users would be appreciated. Direct all comments to Pesticide Applicator Training, 249 Howlett Hall, 2001 Fyffe Court, Columbus, OH 43210.
