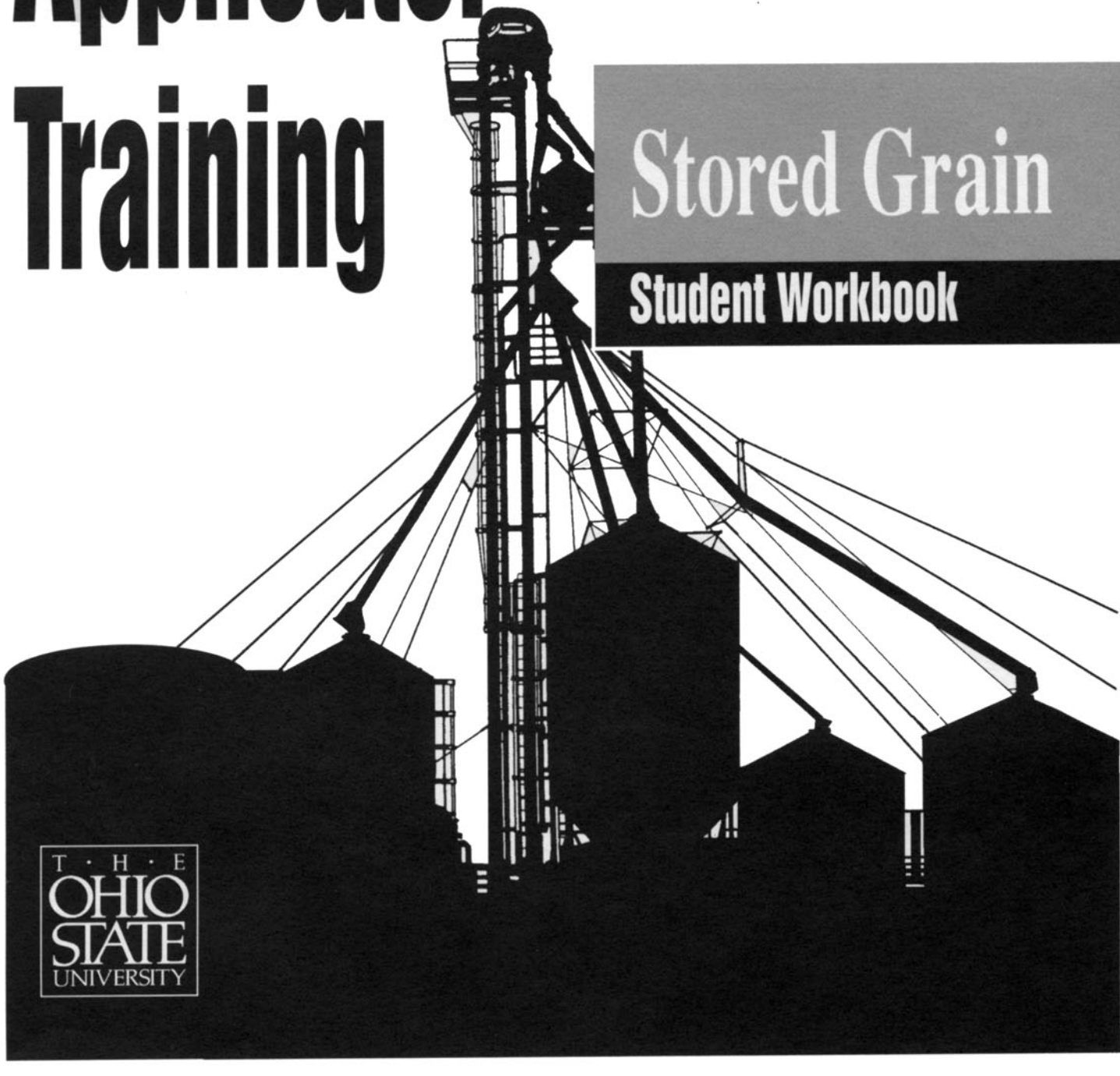
Bulletin 821-10

Ohio Pesticide Applicator Training

Stored Grain

Student Workbook



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Preface

This workbook was prepared by the Ohio Cooperative Extension Service 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 stored-grain category. The sample questions presented in this manual will help the reader obtain a general understanding of stored-grain pest problems, approaches to control, and general information needed to apply and use pesticides safely.

Your comments and suggestions to improve this study tool for future users would be appreciated. Comments should be directed to Pesticide Applicator Training; Extension Entomology; 1991 Kenny Road; Columbus, OH 43210.

How to Use This Workbook

This workbook is designed to serve as a supplementary study guide to Bulletin 153, *Stored-Grain Insect Control,* which is available through county offices of the Ohio Cooperative Extension Service.

Users of this workbook should read Bulletin 153 before attempting to answer the questions. When using this 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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Stored-Grain Insect Control

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1. Which of the following pests can cause grain quality to decrease?

   A. Insects
   B. Molds
   C. Mites
   D. Rodents
   E. All of the above

2. Which of the following is not a basic step in grain pest management?

   A. Storage preparation, including sanitation and chemical treatment of empty storage facilities.
   B. Binning of grain in good condition with application of protective insecticide, if long-term storage is anticipated.
   C. Periodically mixing old grain with new grain to dilute insect infestations.
   D. Periodic monitoring and management of grain to detect pests.
   E. Implementation of corrective procedures when pest populations threaten grain quality.

3. Which of the following statements are true regarding current developments in stored grain?

   A. Malathion is no longer labeled as an empty-bin treatment and grain protectant.
   B. Diclorvos (DVVP, Vapona) has been classified as a possible human carcinogen.
   C. Tempo is a new synthetic pryethroid labeled for surface treatment. Cyfluthrin is the active ingredient.
   D. All of the above
   E. None of the above

4. Field harvesting equipment, grain dump hoppers, and transporting equipment used for grain hauling are not a significant source of pest infestations, so a thorough cleaning is not necessary.

   A. True
   B. False

5. Important sanitation practices include:

   A. Cleaning the entire storage facility including sweeping, vacuuming, and removal of old grain residues.
   B. Cleaning of grain handling equipment including field harvesters, grain dumps, and grain handling and transporting equipment.
   C. Removal of grain pest habitats including weeds, sacks of old seed or feed, and general debris.
   D. All of the above
   E. None of the above

6. After thoroughly cleaning the storage facility, the application of an empty-bin spray or residual spray is needed to eliminate any possible remaining insects.

   A. True
   B. False

1. **Correct Answer: E,** Page 3, Introduction
   Explanation: Insect, molds, mites, and rodents can all cause grain quality to decrease or deteriorate.

2. **Correct Answer: C,** Page 3, Introduction
   Explanation: Mixing old grain with new grain is <u>not</u> a good practice! Storage facility preparation including sanitation and using a residual spray on empty bins is the first step in basic grain pest management. Binning good quality grain with a protective insecticide for long-term storage is the second step. Periodic monitoring and management of grains and implementing corrective procedures when needed are the final steps in grain pest management.

3. **Correct Answer: D,** Page 3, Current Developments
   Explanation: Current supplies of Malathion can be used according to label directions but new labels will not include listings for use on storage facilities or stored grain. Diclorvos was used as a space treatment until it was classified as a possible human carcinogen. Tempo is a new product that exhibits fast knock-down of insect pests.

4. **Correct Answer: B,** Pages 3 and 4, Sanitation
   Explanation: In general, any equipment that may hold grain from a prior season should be cleaned thoroughly to reduce insect infestations. This includes field harvesting equipment, grain dump hoppers, and transporting equipment.

5. **Correct Answer: D,** Pages 3 and 4, Sanitation
   Explanation: Important sanitation practices include a thorough cleaning of storage facility, grain handling equipment, and removal of grain pest habitats, so the answer is all of the above.

6. **Correct Answer: A,** Page 4, Surface Treatments of Empty Storage Facilities
   Explanation: A residual spray or empty-bin spray is generally recommended, even after thorough sanitation procedures have been undertaken to eliminate any remaining insect pests.

7. An objective of residual spray treatments is:

   A. To eliminate insect infestations prior to the storage season.
   B. To overcome the effects of poor sanitation practice.
   C. To maintain an insect-free environment until it is time to store grain.
   D. A and C
   E. B and C

8. Empty-bin treatments should be applied:

   A. One to two hours prior to new grain storage.
   B. One to two days prior to new grain storage.
   C. One to two weeks prior to new grain storage.
   D. One to two months prior to new grain storage.
   E. None of the above

9. Which of the following are common active ingredients in non-restricted residual empty-bin sprays?

   A. Malathion, aluminum phosphide, methyl bromide
   B. Cyfluthrin, pyrethrin, methoxychlor, chlorpyrifros-methyl
   C. Aluminum phosphide, methyl bromide, chlorpyrifros-methyl
   D. Lindane, chlorpyrifros-methyl, chloropicrin
   E. Chloropicrin, aluminum phosphide, methyl bromide

10. Formulations labeled for space treatments of empty storage facilities always have residual properties.

    A. True
    B. False

11. After a bin has been thoroughly cleaned, sanitized, and has had a residual empty-bin spray applied, the primary source of re-infestation by insects in grain bins is:

    A. Through the sub-floor area of bins with aeration floors.
    B. Old feed sacks.
    C. By old grain left on bin ledges and rafters.
    D. All of the above
    E. None of the above

12. If the sub-floor is suspected of having an insect infestation and the area cannot be cleaned or sprayed, an empty-bin fumigation with chloropicrin may be recommended.

    A. True
    B. False

13. Which of the following is <u>not</u> a characteristic of chloropicrin?

    A. It is a restricted-use pesticide.
    B. Chloropicrin is extremely toxic.
    C. It is a grain fumigant for stored grains.
    D. It is a pungent tear gas that is heavier than air.
    E. Its use requires approved respiratory and gas-monitoring equipment.

7. **Correct Answer: D,** Page 4, Surface Treatments of Empty Storage Facilities
Explanation: The two objectives of empty-bin sprays or residual spray treatments is to eliminate insect infestations prior to the storage season and to maintain an insect-free environment until it is time to store new grain. Residual sprays are not an alternative to poor sanitation practices. Both sanitation and residual sprays are needed together to control insect populations.

8. **Correct Answer: C,** Page 4, Surface Treatments of Empty Storage Facilities
Explanation: Preferably, an empty-bin treatment should be applied a week or two prior to binning grain. Waiting one or two days or hours before storing new grain is not recommended because some insects may escape the residual spray and enter the grain mass. After one or two months, the residual spray may start wearing off and new insects may be ready to invade.

9. **Correct Answer: B,** Pages 3 and 4, Surface Treatment of Empty Storage Facilities
Explanation: Cyfluthrin, pyrethrin, methoxychlor, and chlorpyrifros-methyl are non-restricted residual empty-bin sprays. Chloropicrin is an extremely toxic restricted-use pesticide fumigant used in empty bins. Aluminum phosphide and methyl bromide are two restricted-use grain fumigants. Malathion is no longer labeled for residual empty-bin sprays, but existing supplies can be used according to label directions.

10. **Correct Answer: B,** Page 4, Space Treatment of Empty Storage Facilities
Explanation: Formulations labeled for use in grain storage areas may or may not have residual properties. Formulations of methoxychlor provide long-term activity while formulations of pyrethrin provide effective control of present pests, but do not provide residual activity.

11. **Correct Answer: A,** Page 5, Sub-Floor Sources of Infestation
Explanation: With good cleaning and sanitation, old grain should not be left in the bin. A residual spray will eliminate most insect eggs and larvae. Sub-floor areas are the primary source of re-infestation by insects.

12. **Correct Answer: A,** Page 5, Sub-Floor Sources of Infestation
Explanation: Chloropicrin is recommended as an empty-bin fumigant for sub-floors that are hard to clean or those that cannot be treated with a residual spray.

13. **Correct Answer: C,** Page 5, Empty-Bin Fumigation with Chloropicrin
Explanation: Chloropicrin is not a grain fumigant such as aluminum phosphide or methyl bromide. It is used only as an empty-bin fumigant. However, it is a restricted-use pesticide, it is extremely toxic, it is a pungent gas that is heavier than air, and respiratory and gas-monitoring equipment are required.

14. To perform an empty-bin fumigation, apply chloropicrin on a calm day when air temperatures are 65 degrees or less.

    A. True
    B. False

15. Always work in pairs when applying any type of fumigant.

    A. True
    B. False

16. After sealing the empty bin, chloropicrin is poured from a ventilation door on the bin roof. Warning placards are posted according to labeled directions. How long should the applicator wait before airing out the bin?

    A. 48 hours
    B. 24 hours
    C. 12 hours
    D. 6 hours
    E. None of the above

17. At binning time, storing grain at the optimum moisture level will minimize insect infestation and mold development, but it may cause excessive drying costs or weight loss.

    A. True
    B. False

18. The maximum safe moisture content needed for shelled corn and wheat stored for 6 to 8 months is:

    A. Shelled corn = 15% Wheat = 14%
    B. Shelled corn = 18% Wheat = 16%
    C. Shelled corn = 20% Wheat = 18%
    D. Shelled corn = 13% Wheat = 12%
    E. None of the above

19. The maximum safe moisture content needed for shelled corn and wheat stored for more than 1 year are:

    A. Shelled corn = 10% Wheat = 9%
    B. Shelled corn = 13% Wheat = 12%
    C. Shelled corn = 15% Wheat = 14%
    D. Shelled Corn = 20% Wheat = 18%
    E. None of the above

20. The presence of foreign materials such as trash and fines in the grain bin will:

    A. Inhibit drying and aeration.
    B. Contribute to the development of insect populations.
    C. Reduce the effectiveness of preventative and rescue treatments applied to control insects.
    D. All of the above
    E. None of the above

14. **Correct Answer: B,** Page 5, Empty-Bin Fumigation with Chloropicrin
Explanation: Chloropicrin should be applied on a calm day when air temperatures are 65 degrees or **higher**.

15. **Correct Answer: A,** Page 5, Empty-Bin Fumigation with Chloropicrin
Explanation: For safety reasons, it is always a good idea to work in pairs when applying fumigants in case one person is overcome by the toxic gases given off by fumigation.

16. **Correct Answer: B,** Page 5, Empty-Bin Fumigation with Chloropicrin
Explanation: The applicator should wait 24 hours before airing out an empty bin fumigated with chloropicrin. A full-faced gas mask should be used when pouring a liquid fumigant like chloropicrin from the bin roof.

17. **Correct Answer: B,** Page 5, Storage Time Procedures
Explanation: Storing grains at the optimal temperature will minimize insect and mold development and <u>not</u> cause excessive drying costs or weight loss.

18. **Correct Answer: A,** Page 5, Storage Time Procedures
Explanation: For storage times of 6 to 8 months, the maximum safe moisture content for shelled corn is 15% and for wheat is 14%. At moisture levels above this, insect infestation and mold development will occur. At moisture levels below this, drying costs and weight losses are higher.

19. **Correct Answer: B,** Page 5, Storage Time Procedures
Explanation: For storage times greater than 1 year, the maximum safe moisture level for shelled corn is 13% and wheat is 12%. Higher moisture levels will promote insect infestation or mold development.

20. **Correct Answer: D,** Page 5, Storage Time Procedures
Explanation: The presence of foreign material such as fines or trash inhibit drying and aeration, contribute to the development of insect infestations, and reduce the effectiveness of preventative and rescue treatments. Use of grain cleaning equipment minimizes the development of storage problems and is strongly advised at binning time.

21. A grain protectant is an insecticide applied directly to whole grain at binning time to provide a temporary residue on grain to kill insects entering the grain during the initial storage period.

    A. True
    B. False

22. Which of the following statements is true regarding liquid and dust formulations as grain protectants?

    A. Dust formulations are generally preferred due to ease of application and even distribution.
    B. Dust application is preferred where corn is stored on the cob.
    C. A liquid application is preferred if grain has been stored at high temperatures.
    D. As grain protectants, liquid and dust treatments should not be applied as surface treatments.
    E. None of the above

23. Which of the following are advantages of using grain protectants?

    A. Protectants are relatively safe compared to fumigants.
    B. Protectants may be easier to apply than fumigants and may provide protection when it is difficult to fumigate.
    C. Protectants offer insurance by reducing the probability of infestation.
    D. A and B
    E. All of the above

24. Which of the following statements is (are) true?

    A. Actellic should provide protection against all stored-grain insects, including Indian meal moth, for prolonged storage periods if good grain management practices are used.
    B. *Bacillus thuringiensis* (B.t.) as a surface treatment may be used for protection against Indian meal moth.
    C. Reldan can provide protection against all stored-grain insects including Indian meal moth and can be used on all grain products.
    D. A and B
    E. All of the above

25. Grain protectants can be applied by either a simple hand-held sprayer, pump drive drip applicators, or gravity-flow applicators.

    A. True
    B. False

26. For small loads, dust formulation may be applied and mixed evenly to the grain surface assuming that the dust will be mixed thoroughly in the grain during the unloading process.

    A. True
    B. False

27. Grain protectants can be applied to either whole grain or processed grain.

    A. True
    B. False

21. **Correct Answer: A,** Page 5, Application of Grain Protectants
Explanation: This is a true statement. Grain protectants may be applied to the entire grain mass by treating the grain with either a liquid or dust formulation.

22. **Correct Answer: B,** Page 5, Application of Grain Protectants
Explanation: Dust applications are preferred for corn stored on the cob. Liquid formulations are easier to apply and give better distribution. Dust formulations may be used in situations where high temperatures may affect liquid formulations if the grain has been cooled and mixed. Both liquid and dust formulations may be used as surface treatments.

23. **Correct Answer: E,** Page 5, Application of Grain Protectants
Explanation: All the statements are true. Grain protectants are generally easier and safer to apply and also offer insurance against stored-grain infestations.

24. **Correct Answer: D,** Page 6, Grain Protectant Application Methods
Explanation: *Bacillus thuringiensis* (B.t.) is warranted as a surface treatment against Indian meal moth especially if malathion was used as a protectant against other insects. Actellic and Reldan provide good protection against all stored-grain insects, but Actellic cannot be applied to wheat, and Reldan cannot be used on stored corn. Always read the label carefully.

25. **Correct Answer: A,** Page 6, Grain Protectant Application Methods
Explanation: A variety of application methods and types of equipment can be used for applying grain protectants, including use of a simple hand-held sprayer, drip applications, or gravity flow. It is important that the application system be calibrated.

26. **Correct Answer: A,** Page 7, Grain Protectant Application Methods
Explanation: This is a true statement as long as the grain is only a small quantity to be treated such as a truck or wagon load and the dust mixes thoroughly throughout the load. Otherwise, dust should be applied to the grain stream by attaching a specially designed applicator to the auger.

27. **Correct Answer: B,** Page 7, Protectant Use on Whole vs. Processed Grain
Explanation: Grain protectants can be applied only to whole grains, not processed grains. Processed animal feeds should not be treated with a grain protectant! Grain treated with a protectant should not be fed or processed for 30 days following treatment while whole grain should be well-aerated and turned for 48 hours.

28. Most stored-grain systems are insect-free, so the potential for the development of an economically devastating pest infestation is low.

    A. True
    B. False

29. Temperature management is a key factor in managing the grain environment. Development of insect pest populations is directly related to grain temperatures and moisture. Which of the following statements are true?

    A. Insects thrive at grain temperatures from 70 F to 85 F.
    B. Insects die at grain temperatures below 35 F. Temperatures below 40 F inhibit insect activity.
    C. To manipulate grain temperatures, good aeration of the grain is required to achieve rapid cooling.
    D. Aerating during long periods of damp or wet weather should be avoided.
    E. All of the above

30. A trap called the grain probe trap:

    A. Is a plastic probe 15 inches long that acts like a pit fall for numerous grain beetles and immature larva.
    B. Should be placed in the grain surface for 48 hours to detect insect presence. One to four traps are needed.
    C. Are less effective than grain probe tiers used for sampling grain.
    D. A and B
    E. All of the above

31. Periodic inspection of grain is necessary to assure grain quality is maintained during storage.

    A. True
    B. False

32. Which of the following practices are recommended to assure the safety of persons inspecting grain in storage?

    A. Never inspect storage facilities alone.
    B. Always wear safety gear in bins.
    C. Make sure grain handling equipment is off.
    D. Know history of facility.
    E. All of the above.

33. Bin stairs or guard rails are an unnecessary and expensive addition to a grain bin set-up.

    A. True
    B. False

34. Fumigation is generally warranted under what conditions?

    A. Primary pests infesting grain are weevils or grain borers.
    B. Light infestations of bran bugs and moths.
    C. With serious infestation of grain-damaging insects.
    D. A & C
    E. All of the above

28. **Correct Answer: B,** Page 7, Grain Monitoring and Management
Explanation: Recent developments in insect detection methods have established that stored-grain pests are present in nearly all stored-grain systems. Thus, the potential for pest infestations exists at all times. Temperature and moisture levels must be monitored periodically to prevent losses.

29. **Correct Answer: E,** Pages 7 and 8, Temperature Management
Explanation: All the statements are true. Effective manipulation of grain temperatures can minimize development of insect populations. The potential for mold and insect development increases if moisture levels become excessive in a grain environment.

30. **Correct Answer: D,** Page 8, Use of Insect Traps
Explanation: Both A & B are correct. Numerous insects may be trapped if insect populations are well-established. The grain probe trap is actually more effective than grain probe tiers used to sample grain.

31. **Correct Answer: A,** Page 7, Grain Monitoring and Management
Explanation: Monitoring insect infestations and temperature is essential to prevent deterioration of grain in storage.

32. **Correct Answer: E,** Page 8, Storage Facility Access and Safety
Explanation: Following all these practices prevents serious injuries from occurring during grain inspections. Additionally, filtered respirators should be worn in bins to protect lungs from inhalation of dust and spores.

33. **Correct Answer: B,** Page 8, Storage Facility Access and Safety
Explanation: Bin stairs or guard rails should be considered essential to make bin inspection easier and safer. Ease of access helps promote periodic grain inspections to detect insect and fungus infestations.

34. **Correct Answer: D,** Page 8, Corrective Pest Control Procedures
Explanation: Fumigation is warranted when there is a serious infestation of grain-damaging insects or when the primary pests are weevils or grain borers.

35. Identify the primary factor influencing the effectiveness of a fumigant.

A. Temperature
B. Leakage of fumigant gas from facility
C. Humidity

36. What two products are available to fumigate grain bins?

A. Chloropicrin, methyl bromide
B. Aluminum phosphide, chloropicrin
C. Aluminum phosphide, methyl bromide
D. Malathion, chloropicrin

37. Aluminum phosphide is in what form(s) as it comes from the original package?

A. Gas
B. Tablet
C. Pellet
D. Both B & C
E. All of the above

38. A storage facility treated with aluminum phosphide will smell like:

A. Dirty socks
B. Has no smell
C. Ammonia
D. All of the above

39. Which of the following equipment should be available to a person fumigating a grain storage facility with aluminum phosphide?

A. 1.25-inch PVC pipe applicator device
B. Cotton gloves
C. Warning signs
D. Polyethylene sheeting (4 mil)
E. Detection equipment
F. Respiratory equipment
G. All of the above

40. Determining when a grain facility is safe to re-enter requires monitoring equipment that gives exact gas-level readings.

A. True
B. False

41. A full-faced gas mask with canisters labeled for aluminum phosphide gas is the minimum respiratory equipment that should be available when aluminum phosphide is used for fumigation.

A. True
B. False

35. **Correct Answer: B**, Page 8, Corrective Pest Control Procedures
Explanation: The leakage of fumigant gas from the facility is the primary factor influencing fumigant effectiveness. Temperature and exposure time are important considerations, but are secondary to proper sealing of a facility prior to fumigation.

36. **Correct Answer: C,** Page 8, Corrective Pest Control Procedures
Explanation: Aluminum phosphide and methyl bromide remain on the market for fumigating grain storage facilities.

37. **Correct Answer: D,** Page 9, Corrective Pest Control Procedures
Explanation: Aluminum phosphide is packaged as tablets or pellets that form a gas upon exposure to air containing water. This gas permeates the grain mass and kills insects.

38. **Correct Answer: C,** Page 9, Phosphine Gas-Generating Fumigants
Explanation: Aluminum phosphide contains ammonia carbonate, which forms a pungent-smelling ammonia gas that serves as an early-warning agent. This is **not** intended to serve as the primary method of determining when a facility is safe to enter. Gas levels in the bin should be monitored with standard equipment designed for this purpose to determine when re-entry is safe. The ammonia smell is intended to warn that aluminum phosphide is being used.

39. **Correct Answer: G,** Page 9, Phosphine Gas-Generating Fumigants
Explanation: All the listed equipment should be available to effectively and safely fumigate grain storage facilities with aluminum phosphide.

40. **Correct Answer: A,** Page 9, Materials and Equipment Required
Explanation: Smell should not be used as an indicator for safe re-entry of a fumigated building. Monitoring equipment giving exact gas readings should be used. Buildings with less than 0.1 ppm aluminum phosphide are safe for re-entry.

41. **Correct Answer: A,** Page 9, Materials and Equipment Required
Explanation: Respiratory equipment is necessary when pellets are placed in the bin and to monitor gas levels for safe re-entry. Full-faced gas masks with the proper canisters for aluminum phosphide gas are a minimum while a self-contained breathing apparatus is suggested. Two sets of respiratory equipment are needed so both members of the fumigation team have equipment available in case of emergency.

42. Recommended dosages of aluminum phosphide vary depending on which of the following factors?

A. How well the building is sealed.
B. Grain temperature.
C. Condition of the grain.
D. Grain volume to be treated.
E. All of the above

43. Fumigation should not be attempted when grain temperatures are:

A. Below 50 F
B. Below 40 F
C. Below 36 C
D. Below 60 F

44. Two fumigation applicators must be on site when a facility is fumigated, and at least one must be certified.

A. True
B. False

45. Dry cotton gloves are recommended when handling aluminum phosphide.

A. True
B. False

46. Which of the following safety precautions should be used during fumigation with aluminum phosphide?

A. Spend less than 15 minutes in a structure being fumigated.
B. Work in pairs.
C. Use proper respiratory equipment.
D. Begin at farthest point, work toward exit.
E. All of the above
F. None of the above

47. Aluminum phosphide may explode upon contact with water.

A. True
B. False

48. If fumigated grain will remain in storage for an extended period, which of the following is recommended?

A. Do nothing.
B. Periodically fumigate the grain.
C. Apply a grain protectant.
D. Contact ODA.

49. Methyl bromide requires a longer contact time for grain fumigation than aluminum phosphide.

A. True
B. False

42. **Correct Answer: E,** Page 9, Dosage for Aluminum Phosphide
Explanation: The tightness of the building, grain temperature, grain condition, and volume all influence recommended dosages. Improperly sealed bins require a higher dosage. Higher grain temperature increases activity, requiring lower dosages. Grain that has gone out of condition or has many fines will require higher dosages. Grain volume is a key consideration. Dosages are always given as the amount per 1,000 cubic feet or 1,000 bushels. Careful consideration should be given to all these factors before dosage is determined.

43. **Correct Answer: B,** Page 10, Time Period Required for Fumigation with Aluminum Phosphide
Explanation: Fumigation should not be attempted when grain temperatures are below 40 F.

44. **Correct Answer: A,** Page 10, Application Procedures Using Aluminum Phosphide
Explanation: For safety consideration, two individuals must be present during fumigation. One must be a certified applicator, and the other must be trained in fumigation procedures.

45. **Correct Answer: A,** Page 10, Application Procedures Using Aluminum Phosphide
Explanation: Cotton gloves are better than rubber gloves for handling aluminum phosphide fumigants. Cotton breathes, lowering the potential for moisture to build up in the glove where a stray pellet may cause skin burns.

46. **Correct Answer: E,** Pages 10 and 11, Application Procedures Using Aluminum Phosphide
Explanation: All are safety practices that should be followed during fumigations.

47. **Correct Answer: A,** Page 11, Application Procedures Using Aluminum Phosphide
Explanation: Aluminum phosphide pellets react with water to release the fumigating gas. If direct contact with water is made, the reaction may occur so quickly that an explosion occurs. Extra care should be given if ducts are used as entry points for treatment. Water collecting in ducts may contact the pellets, causing an explosion.

48. **Correct Answer: C,** Page 11, Application Procedures Using Aluminum Phosphide
Explanation: Apply a grain protectant to the surface of the grain after the facility is safe to re-enter based on gas readings. This protects against future infestation.

49. **Correct Answer: B,** Page 11, Application Procedures Using Aluminum Phosphide
Explanation: Methyl bromide provides a quicker kill. The shorter time makes it more attractive for use by the professional fumigator even though equipment needed is more extensive and requires more training to use.

50. What type of non-chemical protection could growers use for insect pest control in stored grain?

A. Sanitation
B. Maintenance of good grain condition
C. Diatomaceous earth
D. All of the above

51. What type of pest can damage stored grain?

A. Weevils
B. Borers
C. Moths
D. Beetles
E. All of the above

52. Which of the following insect types lays its eggs inside the grain so damage is hidden?

A. Grain borers
B. Indian meal moths
C. Grain weevils
D. All of the above
E. A & C

53. Indian meal moth activity is typically identified by which of the following characteristics?

A. Internal feeding of grain.
B. Webbing and crusting of grain surfaces.
C. Eating whole grains.
D. All of the above

54. Grain can be effectively protected from Indian meal moth with malathion treatment.

A. True
B. False

55. Aluminum phosphide may be used for the control of burrowing pests.

A. True
B. False

56. When using aluminum phosphide to control burrowing pests:

A. Do not apply within 15 feet of inhabited structures.
B. Do not apply to agricultural or non-cropland areas
C. Do not apply to burrows that may open under or into occupied buildings.
D. A & C
E. All of the above

57. Aluminum phosphide is very toxic to wildlife and should not be applied directly to water or wetlands.

A. True
B. False

50. **Correct Answer: D,** Page 12, Exceptional Situations
Explanation: Exceptional situations such as organic grain may require non-chemical controls for pests. Sanitation and grain maintenance are sound practices regardless of the situation. Diatomaceous earth labeled for stored grain is available as an empty-bin treatment and as a grain protectant. Beneficial insects have not proven to be an effective control measure, although research continues in this area.

51. **Correct Answer: E,** Pages 12 and 13, Stored-Grain Pests
Explanation: All the listed insects can feed on stored grains.

52. **Correct Answer: C,** Page 12, Stored-Grain Pests
Explanation: Grain weevil larvae actually develop inside the grain. This habit makes weevils difficult to detect. Detection of weevils in grain indicates that immature stages exist inside grain kernels and cannot be removed by cleaning.

53. **Correct Answer: B,** Page 13, Stored-Grain Pests
Explanation: Indian meal moth feeding results in the presence of webbing that will coat grain bin surfaces and cause crusting of grain surfaces. This crusting may clog grain handling equipment.

54. **Correct Answer: B,** Page 13, Stored-Grain Pests
Explanation: Indian meal moth is resistant to malathion treatment and shows some tolerance to new chemicals. *Bacillus thuringiensis* can be an effective protectant to treat grain surfaces. Reldan 4E and Actellic 5E are also effective.

55. **Correct Answer: A,** Page 19, Burrowing Pest Control, Student Workbook
Explanation: Aluminum phosphide may be used out-of-doors only for the control of burrowing rodents and moles.

56. **Correct Answer: D,** Page 19, Burrowing Pest Control, Student Workbook
Explanation: Aluminum phosphide can be applied to all agricultural and non-cropland areas, but must not be used within 15 feet of an inhabited structure. It should not be applied to burrows that open under or into occupied buildings.

57. **Correct Answer: A,** Page 19, Burrowing Pest Control, Student Workbook
Explanation: Aluminum phosphide is highly toxic to wildlife, and water contamination should be avoided.

Stored-Grain Insect Control

Score Card

No. of Questions Answered Correctly	% Correct	Evaluation
52-57	> 90%	**Excellent** — You have a very good understanding of stored-grain insect control.
46-51	> 80%	**Good** — Be sure you understand the questions you missed. It may help to read *Stored-Grain Insect Control* (Bulletin 153) and re-answer the questions you missed.
40-45	> 70%	**Poor** — Your score indicates a borderline level of expertise. Be sure to re-read *Stored-Grain Insect Control* (Bulletin 153) and re-answer the questions you missed.
0-39	< 70%	Re-read *Stored-Grain Insect Control* (Bulletin 153) and work through the workbook again.

Burrowing Pest Control

In addition to insects, rodents may pose a threat to stored feed or sacked corn. The following is an excerpt from the **aluminum phosphide label** regarding its use for burrowing pests.

Aluminum phosphide (Phostoxin) may be used out of doors only for the control of the following burrowing rodents and moles: Marmot sp. — Woodchucks and Yellow — Belly Marmots (Rockchucks), Prairie Dogs (except Utah Prairie Dogs), Norway and Roof Rats, Mice, Ground Squirrels, Moles, Voles, Gophers and Chipmunks.

Add 1 to 4 tablets or 5 to 20 pellets to each burrow opening. Then seal tightly by shoveling soil over the entrance after first packing the opening with crumpled newspaper or something similar so as to prevent soil from covering the fumigant and slowing its action. Subsurface tunnels or runways should be treated every 5 to 10 feet with a dose of 2 to 4 tablets or 10 to 20 pellets. Use lower rates in smaller burrows in tight soils under moist soil conditions and higher rates in larger burrows in porous soils when soil moisture is low. Addition of several cups of water to the burrow prior to dosing with aluminum phosphide may improve efficacy in some porous soils. Treat reopened burrows and fresh runways a second time 1 to 3 days after the initial treatment.

Aluminum phosphide may be used out of doors only for control of burrowing pest. Do not use within 15 feet (5 meters) of inhabited structures. Do not apply to burrows which may open under or into occupied buildings. It can be used on all agricultural and noncropland areas.

Aluminum phosphide is very toxic to wildlife. Non-target organisms exposed to phosphide gas in burrows will be killed. Do not apply directly to water or wetlands (swamps, bogs, marshes, and potholes). Do not contaminate water by cleaning of equipment or disposal of wastes.

Notes