# KNOWLEDGE EXPECTATIONS FOR PEST CONTROL ADVISERS: DEFOLIATION AND OTHER HARVEST AID PRACTICES

#### I. INTRODUCTION

- 1. Define:
  - a. defoliation:
  - b. desiccation;
  - c. harvest aid chemical.

# A. The Purpose of Harvest Aids in California Cotton

- 1. List the reasons for using harvest aids.
- 2. List the advantages of manipulating harvest timing.
- 3. Describe how harvest aids sustain quality.

## II. PHYSIOLOGICAL PROCESSES INVOLVED IN DEFOLIATION AND DESICCATION

- 1. Recognize that defoliation is a natural process.
- 2. Describe how the following plant hormones affect senescence and/or abscission:
  - a. cytokinin;
  - b. auxin;
  - c. ethylene;
  - d. abscisic acid.
- 3. Identify, on a cotton plant, the
  - a. leaf abscission zone:
  - b. petiole;
  - c. leaf blade;
  - d. main stem;
  - e. vascular tissue.
- 4. Recognize where leaf abscission takes place on cotton.
- 5. Describe the differences between the leaf cuticle of an old leaf and a young leaf and how this affects the use of harvest aids.
- 6. Describe how plant water stress can affect penetration of harvest aid chemicals through the leaf cuticle.
- 7. Distinguish the difference in plant response to application of chemicals classified as defoliants versus desiccants.
- 8. List conditions that affect the rate and degree of natural defoliation occurring in late season cotton. [insects, leaf age, disease, water stress, fruit load, nitrogen level]

## III. COTTON

- 1. Describe the crop cycle of cotton in California. (typical planting dates, plant growth regulator applications, primary flowering period timing, harvest dates)
- 2. Describe the stages of cotton growth and how long each takes.
- 3. Describe the approximate amount of time after flowering it takes a boll to
  - a. reach final fiber length;

- b. develop a high viability seed;
- c. reach fiber maturity;
- d. mature to a cracked, open, harvestable boll.
- 4. Describe how conditions during flowering and boll development can affect boll quality and maturation.
- 5. Describe how defoliant efficacy is impacted by the perennial nature of the cotton plant.
- 6. List some differences between growth habits and lint quality of California Upland/Acala and Pima varieties of cotton.
- 7. Define:
  - a. boll;
  - b. cracked boll;
  - c. cutout:
  - d. first-position boll;
  - e. module;
  - f. nodes above crack boll (NACB);
  - g. rank growth;
  - h. square.

#### IV. HARVEST AIDS AND THEIR USES

# A. Preparing for Harvest Aid Applications

- 1. Describe how to determine the need for use and most appropriate application timing for
  - a. defoliants:
  - b. desiccants;
  - c. boll openers;
  - d. other materials used as harvest aids.
- 2. Describe how the following factors can alter the choice and effectiveness of harvest aids:
  - a. air temperature at application;
  - b. arthropod pests—aphids, whiteflies, and spider mites;
  - c. humidity/precipitation;
  - d. plant nitrogen status;
  - e. plant vegetative vigor/leaf canopy density;
  - f. plant water status;
  - g. plant/fruit maturity;
  - h. weed infestations.
- 3. Describe how the presence of johnsongrass, pigweed, nightshade, and annual and perennial morningglory can affect harvest aid use decisions.
- 4. Identify how target harvest dates are determined.
- 5. Describe how to determine boll maturity and uppermost harvestable bolls using the following methods:
  - a. nodes above cracked boll (NACB);
  - b. sharp knife technique;
  - c. percent open bolls;
  - d. seed coat color change.

- 6. Describe how to measure nodes above cracked boll (NACB).
- 7. Describe the relationship between harvest aid application timing based on Nodes Above Cracked Boll (NACB) and yield and fiber quality.

## **B. Environmental and Plant Factors Affecting Defoliation**

- 1. Describe the general effects of the following factors on the ease of cotton defoliation:
  - a. boll load:
  - b. difficulty in chemical penetration of plant cover;
  - c. humidity;
  - d. insects;
  - e. plant size and vigor;
  - f. plant water stress:
  - g. soil water availability;
  - h. soil and plant nitrogen;
  - i. temperature;
  - j. weeds.
- 2. Recognize the general differences in response to harvest aid material choices and timing in the Pima versus Upland/Acala varieties of cotton.
- 3. Describe how vegetative growth is affected by:
  - a. early or mid-season boll retention;
  - b. lygus damage;
  - c. nitrogen levels;
  - d. soil water levels:
  - e. temperature.
- 4. Describe how the relative level of plant vigor affects defoliation.
- 5. Explain why regrowth can occur and how to manage it.
- 6. List plant and cultural management factors important in assessing regrowth potential.
- 7. Describe how incomplete leaf drop increases gin trash, which reduces the quality and successful module storage of lint.

#### C. Types of Harvest Aids

- 1. Recognize that harvest aids can
  - a. have herbicidal activity
  - b. have hormonal activity
  - c. act as boll openers
  - d. act as defoliants and/or desiccants
- 2. Understand that the results of harvest aid use can depend upon many factors including water and nitrogen status and plant vigor, environmental conditions, and application rates.

#### Defoliants

- 3. Recognize that the following materials are defoliants and can be used at certain rates and environmental conditions:
  - a. dimethipin;

- b. sodium chlorate;
- c. thidiazuron;
- d. tribufos;
- e. thidiazuron plus diuron.
- 4. List the conditions that favor the use of defoliants and how an appropriate defoliant and application rate is determined.
- 5. Recognize that defoliants induce plant stress to help initiate defoliation but do not kill plants.

#### Desiccants

- 6. Recognize that the following materials can be used as desiccants at certain rates and environmental conditions:
  - a. paraquat;
  - b. sodium chlorate.
- 7. Describe how desiccants affect plant cells.
- 8. Describe how the following factors affect the efficacy of desiccants:
  - a. air temperature;
  - b. humidity;
  - c. plant-water status;
  - d. plant canopy density;
  - e. prior use of harvest aids;
  - f. rate of desiccant application;
  - g. soil residual moisture.

## Boll Openers

- 9. Recognize that the following materials are boll openers:
  - a. ethephon;
  - b. ethephon plus AMADS;
  - c. ethephon plus cyclanilide;
  - d. dimethipin.
- 10. Describe the use of boll openers as harvest aids.
- 11. Recognize the proper application timing for boll openers.
- 12. Describe conditions in which the application of a boll opener would reduce quality and yield.

#### Other Harvest Aid Materials

- 13. Recognize the following materials and understand how they are used on cotton in California:
  - a. endothall;
  - b. glyphosate.
- 14. Recognize the benefits of using glyphosate as a harvest aid. [enhanced defoliation; weed control; regrowth control]

#### Harvest Aids for Organic Cotton

15. Recognize that the following materials can be used as harvest aids for organically grown cotton:

- a. magnesium chloride;
- b. zinc sulfate;
- c. zinc sulfate plus Chilean nitrate;
- d. zinc plus citric acid.
- 16. Describe a problem associated with the use of magnesium chloride in organically grown cotton.
- 17. Explain why organically grown cotton typically cannot be stored in modules even when machined harvested.

# Adjuvants

- 18. Describe the function of adjuvants when using harvest aids.
- 19. Recognize that defoliant labels list required or recommended adjuvants.

# D. Application Methods and Considerations for Harvest Aid Use

- 1. Describe some environmental, safety, and coverage problems associated with harvest aid application by aircraft.
- 2. Describe situations in which applications of harvest aids using ground equipment would be advantageous.
- 3. Describe the importance of leaf coverage for desiccant or defoliant effectiveness.
- 4. Explain how droplet size is adjusted and how, under certain conditions, it can impact harvest aid effectiveness.
- 5. Describe regulations that apply to the use of harvest aids.
- 6. Recognize the most appropriate combination of harvest aids for the following situations:
  - a. <u>Condition 1</u>: fields with uniform or heavy boll load, abrupt cutout, and warm temperatures (>80°F) at and following application.
  - b. <u>Condition 2</u>: late plantings, low boll retention, rank growth and/or cool temperatures (<80°F) at application.