

Pest Management and Sanitation Uses of Propane in Agriculture

LESSON 13

UNIT: PROPANE

PROBLEM AREA: PROPANE USE IN AGRICULTURE



STUDENT LEARNING OBJECTIVES

Instruction in this lesson should result in students achieving the following objectives:

1. Identify pest management and sanitation applications for propane.
2. Evaluate the use of propane for pest management and sanitation.
3. Explain the advantages of propane in organic food production.
4. Identify equipment for pest management and sanitation applications.

NATIONAL SCIENCE STANDARDS ADDRESSED IN THIS LESSON

All students should develop an understanding of:

Life Science: Content Standard C

- Matter, energy, and organization in living systems

Science and Technology: Content Standard E

- Abilities of technological design

**Science in Personal and Social Perspectives:
Content Standard F**

- Environmental quality

LIST OF RESOURCES

The following resources may be useful in teaching this lesson:

- Propane.com/Agriculture
- Energy.gov
- PropaneSafety.com

LIST OF EQUIPMENT, TOOLS, SUPPLIES, AND FACILITIES

- Copies of sample test
- Visuals from accompanying masters
- Copies of student lab sheet

TERMS

The following terms are presented in this lesson (*shown in bold italics throughout the lesson*):

1. insect foggers
2. integrated pest management (IPM)
3. mosquito sprayers
4. pest
5. poultry house sanitation
6. propane cannons
7. thermal pest management

TELL STUDENTS...

“Today you will learn about pest management and sanitation applications for propane. You will be expected to explain the advantages of using propane for general pest management and for sanitation applications. In addition, you will be expected to identify equipment. You also will be required to explain the advantages of using propane for organic food production.”

INTEREST APPROACH

Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situations. Possible interest approaches are included here.

APPROACH 1: IDENTIFYING THE PURPOSE

1. Display **VM-A**. Ask students to guess the purpose and use of the item (a propane cannon) in **VM-A**. Explain how the cannon is set off (by an automatic timer) in fields at specific intervals to chase off unwanted pests (e.g., birds, deer, and other wildlife) that damage crops.
2. Make sure you tell them that the cannon does not shoot the animals; it simply makes loud noises. Show how the propane cannon works, and explain how it is important to place the cannons far away from people and homes because of noise pollution.

APPROACH 2: FIELD TRIP

1. Because the cannons are very loud, it is not recommended to set one off on school property. A field trip can be scheduled to a local orchard or a farm that uses propane cannons.
2. Prior to the trip, you may suggest that students visit YouTube to see videos of the cannons being fired, or project one of these videos for the class.
3. If a field trip is taken, make sure you or the orchard owner fire the propane cannon.

Summary of Content and Teaching Strategies

OBJECTIVES 1

Identify pest management and sanitation applications for propane.

ANTICIPATED PROBLEM

What are the best pest management methods and sanitation applications using propane?

Pest management addresses problems with human health and environmental and economic issues. A **pest** is anything — plant or animal — that causes destruction to humans or human concerns. Propane-based products are a cost-effective, environmentally friendly, and generally beneficial pest control method. Propane is a byproduct of petroleum products or natural gas that is nontoxic, odorless, and colorless in its natural state. An odorant (scent of rotten eggs) is added to propane so it can be easily detected if a leak occurs. Some common propane pest control methods are listed below.

- A. **Thermal pest management** is a nonchemical method of killing pests by using high temperatures to dehydrate or cause heat stress. This method can be used to treat entire buildings or for specific areas by heating the area (120 ° to 160°F). The higher the temperature, the better the results in quantity of pests killed. Depending on the temperature used, this process can take one to three days. The heat is pumped in from tubes or vents to kill pests (e.g., roaches, grain beetles, bed bugs, rodents, and spiders). Fortunately, pests cannot build up a resistance to thermal pest control.
- B. **Insect foggers** are devices used to kill mosquitoes, flies, black flies, gnats, and moths. They use an insecticide and are powered by a small propane tank connected to a coil heater and spray nozzle. The insecticide is heated and sprayed as a fog into bushes and along cracks and wall crevices. The fog leaves a small trace of residue on objects, which normally disappears in six hours or less.
- C. **Propane cannons** are relatively inexpensive and are a low-maintenance form of noise control for birds, deer, and other wildlife. Cannons are usually placed directly in orchards to keep the animals from eating the fruit. They are set on a timer to make a loud sound like a shot gun at regular intervals, often every few minutes. The apparatus gets its name from the propane tanks attached to metal devices that resemble cannons. Unfortunately, birds and animals may become acclimated to the noise over time.
- D. **Mosquito sprayers** use propane converted to a spray of carbon dioxide, heat, and moisture to attract and kill mosquitoes. The sprayers are capable of protecting up to an acre of land. The carbon dioxide produced by the propane attracts mosquitoes just as the carbon dioxide in a human's breath attracts them. When the mosquitoes fly near the device, they are vacuumed into a net where they dehydrate and die.
- E. **Poultry house sanitation** is essential to prevent and control diseases that decrease bird weight gains and livability. Producers sanitize poultry house litter (the mix of manure and bedding that collects on the floor) to destroy disease causing pathogens. Propane-powered poultry house sanitizers produce high heat (2,000 °F) that kills harmful pathogens and reduces ammonia levels that accumulate. Bacteria, viruses, and fungi cannot build resistance to heat; however, they can build a resistance to chemical disinfectants. Also, there is no residue or water contamination risk with propane used for sanitation.

SUGGESTED TECHNIQUES TO HELP STUDENTS MASTER THIS OBJECTIVE

1. Prior to covering this objective, write the terms on the board.
2. Give the students a total of five minutes to define the listed words or to draw them. Collect and review them.
3. Then lead into a discussion of this objective.

OBJECTIVE 2

Evaluate the use of propane for pest management and sanitation.

ANTICIPATED PROBLEM

How effective are propane pest management and sanitation techniques?

When deciding the best management or sanitation plan for pests, it is best to use the steps of integrated **pest management (IPM)**—a planned program that coordinates economically and environmentally acceptable methods of pest control while trying to use the least amount of toxic chemicals. IPM programs are based on a careful assessment of local conditions, available controls, and pest characteristics. The steps for proper IPM are as follows: (1) Inspect and investigate the area. (2) Identify the pest. (3) Monitor the area. (4) Choose control methods. (5) Go back and inspect. (6) Educate others regarding how to keep pests away. Propane has many benefits for integrated pest management because it is economical and environmentally friendly.

- A. Using pest management with propane is beneficial for the environment because it is a nontoxic gas; propane was listed in the 1990 Clean Air Act as an acceptable alternative fuel. The fogger used for dispensing the heat leaves a small trace of chemical residue behind compared to the use of traditional chemical insecticides that leave much more residue. Using heat produced with propane is also approved by the organic standards of pest control.
- B. Thermal pest management has safety benefits. For instance, the re-entry time (to the area) is short, unlike chemically fumigated areas. Using propane is also effective because the heat reaches places that fumigants cannot, and the heat from propane does not corrode machinery.

SUGGESTED TECHNIQUES TO HELP STUDENTS MASTER THIS OBJECTIVE

1. Ask students if they have ever noticed dead bugs in their cars.
2. Explain that the temperature inside a car rises quickly—especially in the sun when the windows are up. As a result, bugs are killed without the use of chemicals.
3. Be sure that students understand that heat used in pest management is safe and much more environmentally friendly than chemicals.

OBJECTIVE 3

Explain the advantages of propane in organic food production.

ANTICIPATED PROBLEM

What are the advantages of propane in organic food production?

The use of environmentally friendly propane is approved for crops to be certified as USDA organic and is commonly used for fruit and vegetable crops. It can be used to steam or flame-control weeds, or it can be used in propane cannons to scare away pests. Both methods help increase yields. Propane also boosts yields of greenhouse crops.

- A. Each year, approximately 5 to 15 percent of the world's crops are damaged by cold temperatures. Economic losses can be tremendous. For example, if frost damaged just 10 percent of the U.S. apple, pear, and sweet cherry harvest, economic losses could be as high as \$300 million. Some farmers use economical propane heaters to keep the harvest safe for short freeze periods. Propane is a more environmentally friendly fuel than other options used in orchard heating.
- B. Weed control is a major problem for organic farmers. Many use equipment that operates on clean-burning propane to produce flame or super-heated steam that is then applied directly to the weeds. The flame vaporizes water within the plant's cells and destroys the plant's photosynthetic capabilities. The cells of the plant rupture and kill the weed. Flame and steam weed-control equipment provide farmers with modern weed-control options that are compliant with the USDA's National Organic Program guidelines because the equipment uses no pesticides.

SUGGESTED TECHNIQUES TO HELP STUDENTS MASTER THIS OBJECTIVE

1. Ask students if they or their parents have ever left plants (e.g., aloe) on the porch during cold temperatures. Ask what happened.
2. Explain that plants can wilt and die quickly due to extreme temperatures, and propane can help prevent plant loss.

OBJECTIVES 4

Identify equipment for pest management and sanitation applications.

ANTICIPATED PROBLEM

What propane equipment is designed for and used in pest management and sanitation applications?

When deciding what control method to use in a pest management and sanitation program, it is important to consider the size and cost of machines in addition to how they run. Some examples of propane equipment for pest management are direct-fired heaters, insect foggers, propane cannons, mosquito sprayers, poultry house sanitation, and steam/flame equipment.

- A. **Thermal pest management** uses direct-fired heaters with high flow rates to provide uniform temperatures throughout the structure or area, killing the insects that are attempting to escape. If thermal pest management is used on a building, the structure must be covered with a large tent because the air that is pumped in can be 120° to 160°F.
- B. **Insect foggers** rid areas of mosquitoes, flies, black flies, gnats, and moths for hours during the day or at night. Fog drifts easily through dense foliage to kill flying insects for complete and effective coverage. The fog disperses quickly and leaves little active residue. Easy trigger action with lockable one-hand on/off control prevents accidental discharge. No matches are required with the insect fogger as there is a self-igniting starter switch to provide positive, cleaner ignition. The design also makes it convenient to take the fogger anywhere. The insect fogger also attaches to a standard propane canister. (**Note:** Display **VM-A**.)
- C. **Propane cannons** are used to keep animals, such as deer and birds, away from crops and orchards. They have timers that trigger a spark at set intervals, igniting the propane. A regulated amount of propane gas flows into the device at a given time. The propane explodes, making a loud noise that is similar to that of a shotgun blast (115 to 130 decibels, depending on the brand and model) as frequently as every 30 seconds. They are relatively inexpensive to buy (e.g., a few hundred dollars per cannon) and are inexpensive to operate and maintain. (**Note:** Display **VM-B**.)
- D. **Mosquito sprayers** protect up to an acre of land. These eliminators use a remarkably effective design. They turn propane into carbon dioxide (the primary attractant for mosquitoes), heat, and moisture. When mosquitoes fly toward the eliminator, they are vacuumed into a net where they die of dehydration. (**Note:** Display **VM-C**.)
- E. **Poultry house sanitation** can be accomplished by using the poultry house sanitizer to generate heat from under a steel hood moved across the poultry house floor. The intense heat kills pathogens, reduces ammonia levels, and controls harmful diseases. The poultry house sanitizer provides a cost-competitive alternative to chemical disinfectants by eliminating the risks of chemical residue as well as water and soil contamination.
- F. **Steam/flame weed control** can be used in fields with a hand-held device or with a tractor mount for large crop sites. It kills the young herbaceous material in the crop and kills pests. This is beneficial because weeds and pests are large problems on organic farms. (**Note:** Display **VM-D**.)

SUGGESTED TECHNIQUE TO HELP STUDENTS MASTER THIS OBJECTIVE

1. Use VM-A, VM-B, VM-C, and VM-D to help students visualize propane equipment that is used in pest management and for sanitation.

REVIEW/SUMMARY

Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. The anticipated problems can be used as review questions.

APPLICATION

Use the included visual masters to apply the information presented in the lesson.

EVALUATION

Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

ANSWERS TO SAMPLE TEST

Use the included lab sheets to apply the information presented in the lesson.

PART ONE: MATCHING

1. d
2. f
3. a
4. e
5. c
6. b

PART TWO: SHORT ANSWER

1. Answers will vary. Example: Propane is considered an alternative fuel that is nontoxic. This would be beneficial on an organic farm so they would not have to worry about toxic insecticides.
2. Answers will vary. Example: Two pros to using propane cannons are they are relatively inexpensive to buy, and with the propane, they do not cost much money to maintain. Two cons would be sometime birds can become acclimated to the noise, and the cannons are very loud for close neighbors.
3.
 - a. Inspect and investigate the area.
 - b. Identify the pest.
 - c. Monitor the area.
 - d. Choose control methods.
 - e. Go back and inspect.
 - f. Educate others on how to keep pests away.

PART THREE: COMPLETION

4. cold temperatures
5. Mosquito sprayers
6. alternative fuel
7. Weeds

Pest Management and Sanitation

Uses of Propane in Agriculture

PART ONE: MATCHING

INSTRUCTIONS: Match the term with the correct definition.

- a. propane cannons
- b. poultry house sanitation
- c. insect foggers
- d. integrated pest management (IPM)
- e. pest
- f. thermal pest management

- _____ 1. A planned program that coordinates economically and environmentally acceptable methods of pest control while trying to use the least amount of toxic chemicals
- _____ 2. A nonchemical method of killing pests by using high temperatures
- _____ 3. Noise control for birds, deer, and large wildlife
- _____ 4. A plant or animal that causes destruction to humans or human concerns
- _____ 5. Devices used to kill mosquitoes, flies, black flies, gnats, and moths
- _____ 6. A management method that is used to prevent and control diseases that decrease bird weight gains

PART TWO: SHORT ANSWER

INSTRUCTIONS: Provide a short written answer to the following questions.

1. Why would using propane pest management systems be beneficial to organic farmers?
2. What are the pros and cons of using propane cannons in an orchard?
3. What are the six steps to IPM?

PART THREE: COMPLETION

INSTRUCTIONS: Provide the word or words to complete the following statements.

1. Each year, approximately 5 to 15 percent of the world's crops are damaged by _____.
2. _____ is a device that uses propane that is converted into a spray of carbon dioxide, heat, and moisture.
3. In 1990, propane gas was listed in the Clean Air Act as an acceptable _____ to use.
4. _____ are a major problem on organic farms.

Propane Insect Fogger



A propane insect fogger works well to kill flying pests.

Propane Cannon



A propane cannon in an orchard can scare pests away.

Mosquito Sprayer



A mosquito sprayer releases carbon dioxide, moisture, and heat to attract mosquitoes that are sucked into the machine.

Steam/Flame Weed Control



A steam/flame weed control system is used in fields with a tractor mount for large crop sites.