Unit 1. Introduction

Learning Objectives

After studying this unit, you will be able to:

• Define chemigation and how it is used in Hawaii.
• Explain the scope and purpose of this manual.
• Understand federal and state laws about chemigation.
• Define integrated pest management (IPM).

This unit explains what chemigation is. It defines the scope of the manual and discusses its purpose through an overview of all six units. This manual focuses on pesticide chemigation: applying herbicides, insecticides, fungicides, nematicides, and other chemicals through an irrigation system. You will learn about the laws requiring backflow prevention to reduce the threat of water pollution. You will also learn that chemigation is one aspect of a well-planned IPM program.
Terms to Know

Backflow—The movement of a liquid in reverse of the normal direction of flow in a piping system. In chemigation systems, backflow can also occur in the injection line, causing the pesticide supply tank to overflow.

Chemigation—The application of a pesticide or fertilizer through an irrigation system. This can occur on many sites, including greenhouses, crop fields, and golf courses.

Drip/trickle Irrigation (Microirrigation)—An irrigation method in which water is applied through drip emitters with very low flow rates using flexible hose or tape.

Fertigation—The application of fertilizer directly through an irrigation system.

PR Notice 87-1—Part of the Label Improvement Program (LIP). It requires pesticide registrants (manufacturers) to state on the product label whether (and how) a pesticide may be chemigated.

Rinsate—Pesticide-containing water (or other liquid) that results from rinsing a pesticide container, pesticide equipment, or other pesticide-containing articles.

Soil Amendments—Materials added to soil, such as peat moss, bark, perlite, or sand. Soil amendments may help improve nutrition, prevent compaction, or improve drainage.

Sprinkler Irrigation—An irrigation method in which water is sprayed or sprinkled through the air to the ground.

Surface/Gravity-Flow Irrigation—Irrigation methods consisting of flood and furrow techniques.

Hawaii Department of Agriculture—The state agency that regulates pesticides and pesticide applicators under the authority of the Hawaii Pesticides Law and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) on behalf of the Environmental Protection Agency (EPA).

Hawaii Department Health—The state agency responsible for implementing most environmental rules (other than pesticide application and registration) set by the EPA.
Overview of Chemigation

Chemigation is the application of agricultural chemicals through an irrigation system. These chemicals include fertilizers, soil amendments, herbicides, insecticides, fungicides, nematicides, algacides, and plant growth regulators. There are many benefits to chemigating as well as some drawbacks. Keep in mind that having an irrigation system does not always mean you can use it to apply pesticides. You may apply a pesticide through an irrigation system ONLY if the product label states that you may do so.

Think of your irrigation system as a distribution and application network with a hose, pipe, or other conduit that connects to a water source. This source can be groundwater (well water), surface water (from a reservoir, stream, or ditch), or municipal water provided by your calm tea water supply agency or by private suppliers. The water distributes the pesticide through one of three types of systems:

- sprinkler,
- drip/trickle (also known as microirrigation), or
- surface/gravity flow (also known as surface run).

The right equipment is vital to successful—and legal—chemigation. This means you need the right kind of tanks, pumps, and calibration tubes. You also must have approved antipollution (safety) devices. Federal and state laws require safety devices on chemigation equipment to protect all source water. These devices will prevent backflow, spills, and any pollutant discharges into water bodies. Check valves, lowpressure drains, and vacuum relief valves, for example, keep the chemical–water mixture from draining or siphoning back into the water supply. Consult the pesticide label to find out:

- whether the product can be applied through an irrigation system,
- what type of system is allowed, and
- what safety (backflow prevention) devices are required for chemigation.

Scope of This Manual

This guide was written for people who are studying for a Hawaii Department of Agriculture examination to qualify for a restricted use pesticide certification in either one of the following categories:

- Commercial applicator category 11 (chemigation pest control). A requirement for certification in this category is concurrent certification in one of the following commercial applicator categories: 1A (agricultural plant pest control), 2 (forest pest control), 3 (ornamental and turf pest control), or 10 (demonstration, research and instructional pest control).
- Private applicator category 2 (agricultural chemigation pest control). A requirement for certification in this category is concurrent certification in the private applicator category 1 (general agricultural pest control).

Purpose of This Manual

The purpose of this manual is to help you practice pesticide chemigation safely and effectively in Hawaii. It starts by describing the federal and state laws that govern pesticide chemigation and safeguard the state’s public and private water sources. You will learn that the pesticide label is a legal document with the full force of federal law. The label tells you whether, where, and how you may chemigate.

Next, you will learn the benefits and drawbacks of pesticide chemigation as well as some important points to keep in mind before you begin. First, make sure that the location, soil type, and landforms of the site will allow successful chemigation. Of course, you must consider the specific pest(s) you wish to control. There are many types of pesticide chemigation; which to use depends on your target pest. These include the application of:

- fungicides,
- insecticides,
- herbicides,
• nematicides.

As with any form of pesticide application, safety is a major concern. You must decrease environmental hazards such as drift and runoff. You must also protect workers through proper posting and restricted-entry intervals. Finally, the safety of the applicators themselves is vital. You will learn how to protect yourself and those around you while chemigating. You will also learn what to do in case of a pesticide accident or spill.

As a chemigator, your equipment is vital to success. This manual will describe the most common types of irrigation systems and the basic chemigation equipment for each. You will learn which type of injection pump is best for your purpose. You will also discover the importance of an accurate calibration tube and of safety devices. In addition, this manual will give maintenance and troubleshooting guidelines. These will help you better manage your chemigation tasks.

Because of the danger of water pollution while chemigating, this manual will devote an entire unit to backflow prevention. Water pollution is the greatest hazard of chemigation and carries severe health and legal consequences. You will learn about the most common—and effective—types of anti-pollution devices as well as some alternative ways to prevent backflow.

The final unit in this manual discusses calibration. Calibration helps you to apply pesticides uniformly and at the correct rate. This manual describes step by step how to calibrate the main types of irrigation equipment for chemigation. It also includes examples to help you do the calculations. Use manufacturers’ data only as a starting point. Always calibrate your own equipment before applying any pesticide for any purpose.

History of Chemigation

Applying chemicals with irrigation water is not new. Chemigation has existed since the 1950s and has expanded nationwide to several million acres. The earliest application of chemicals through sprinklers involved injecting fertilizer into an irrigation system. Herbigation followed and was most commonly done with center pivots and a long spray boom. Other chemicals then came into use: insecticides, fungicides, and nematicides. In time, all these terms became known as “pesticide chemigation.”

Laws and Regulations

Both federal and state laws control the practice of chemigation. Laws sometimes change, however, and new ones come into effect. For this reason, you should regularly check with the Hawaii Department of Agriculture, Pesticides Branch for the latest information.

Federal Laws

All pesticide applications, including those made through an irrigation system, are subject to the provisions of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) as amended. FIFRA contains three mandates important to pesticide applicators:

1. Use pesticides only as directed by the label.
2. Purchase restricted use pesticides only if you are a certified applicator.
3. Apply restricted-use pesticides only if you are a certified pesticide applicator or are supervised by a certified applicator.

FIFRA also says that the site or crop to which you plan to apply the pesticide must appear on the label. It is a violation of FIFRA to use a pesticide if the site or crop is not listed on the label.

Pesticide Labels

One of the reasons a pesticide label is so important is that, under FIFRA, it is considered a legal document. This means that the label—the paper attached to the pesticide container along with any other material—has the same force as federal law. If you use a pesticide in a manner inconsistent with its labeling, you are breaking a law and may
be prosecuted. Before you buy or use any pesticide, read and fully understand everything on the product label.

Label Improvement Program
(PR Notice 87-1)

A pesticide label must have the information you need to help you decide whether to buy the product for chemigation. As of 1988, the U.S. Environmental Protection Agency (EPA) began enforcing a Label Improvement Program (LIP). This program, which includes Pesticide Registration (PR) Notice 87-1, requires the registrants (manufacturers) of all pesticides under FIFRA to state on the label whether the product may be chemigated. The label cannot remain silent on chemigation. If the pesticide may not be applied through an irrigation system, the following statement must appear on the label:

Do not apply this product through any type of irrigation system.

If the label does not contain information about chemigation, the product cannot be chemigated.

If the product may be chemigated, the label must say which type(s) are allowed. For example, if a product may only be applied through drip irrigation, the label would read like this:

Apply this product only through drip irrigation systems. Do not apply this product through any other type of irrigation system.

The label requirements apply to pesticides labeled for use in:

- agriculture (ex. food, fiber, and field crops; nursery stock; and sod),
- nurseries,
- turf farms,
- golf courses, and
- greenhouses.

They do not apply to products that are intended solely for:

- residential use,
- direct injection into plants, or
- postharvest application to produce.

They also do not apply to pesticides applied only as a solid or a gas.

Posting Requirements

On some sites, the EPA, under FIFRA, requires that you post chemigated areas when you use a Toxicity Category 1 product. This includes pesticides with the label signal word DANGER. The signs must clearly warn workers that pesticides are being applied in irrigation water. For products in other toxicity categories, always check the label to see whether posting is required. See Unit 3 (Safety Considerations) for more information about worker safety.

Antipollution Devices

Federal law also says that the label of any pesticide approved for chemigation must spell out what type of safety equipment is required to prevent pollution during chemigation. For example, pollution control features for sprinkler chemigation include an irrigation mainline check valve, a vacuum relief valve, and an automatic low-pressure drain. All of these devices are located on the irrigation pipeline. You may also need an injection-line check valve and a simultaneous interlock. See Unit 5 (Backflow Prevention) for details on safety equipment and backflow prevention.

Water Pollution Control Act (Clean Water Act)

The Water Pollution Control Act gives the federal government authority over surface waters such as streams, rivers, lakes, and oceans. If you, as a chemigator, pollute any of these water bodies, you may have violated this law. The HDOH also regulates water quality and pollution control in surface-water bodies within the state. Further, the HDOH has responsibility for protecting Hawaii’s groundwater from contamination.
Other Federal Laws

The Safe Drinking Water Act protects public drinking water. Its focus is on protection of drinking water quality. Your irrigation system may connect to a public drinking water source. If so, you will need to install special equipment to prevent backflow of chemicals into the drinking water supply.

The Resource Conservation and Recovery Act governs disposal of pesticides, pesticide containers, and rinsate. Be sure to follow label directions carefully before you discard these items.

Hawaii Laws

The State of Hawaii regulates pesticide use through the Hawaii Pesticides Law, the Hawaii Administrative Rules, and through the Hawaii Department of Health. These are discussed below.

Hawaii Pesticides Law

The Hawaii Pesticides and Law (HPL) lays out the basic authority and framework for the regulation of pesticides within the state. The requirements spelled out in this law are part of the Hawaii Revised Statutes. The HPL affects all pesticide applicators in Hawaii. Be sure to keep up with its current provisions.

HPL specifically states, “No person shall fill with water, through a hose, pipe or other similar transmission system, any tank, implement, apparatus, or equipment used to disperse pesticides, unless the tank, implement, apparatus, equipment, hose, pipe or other similar transmission system is equipped with an air gap or a reduced-pressure principle backflow device meeting the requirements under section 340E-2 and the rules adopted thereunder.”

Chapter 340E-2 authorizes the Department of Health to promulgate Hawaii Administrative Rules pertaining to: (1) the enforcement of standards are drinking water quality [Chapter 11-20 rules relating to potable water systems]; (2) the regulation of cross-connections and backflow prevention [Chapter 11-21 cross-connection and backflow control]; and (3) the administration of an underground injection control program [Chapter 11-23 underground injection control]. Chapter 11-21 specifically requires an approved reduced pressure principle backflow prevention device or air gap separation “before any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system.”

The HPL authorizes the Hawaii Department of Agriculture to promulgate regulations in order to carry out its duties under the law. These regulations are written down in the Hawaii Administrative Rules.

Hawaii Administrative Rules

The Hawaii Administrative Rules (HAR) requires all pesticide applicators who will use or supervise the use of restricted use pesticides through an irrigation system to be certified.

Chapter 11-21 of the HAR sets requirements for the location of backflow prevention devices on both public water systems and irrigation systems. For irrigation systems, specific types of backflow preventers are required at specific locations in the irrigation system. Section 11-21-7 requires a reduced pressure principle backflow preventer or air gap separation before any piping network in which fertilizers, pesticides and other chemicals or toxic contaminants are injected or siphoned into the irrigation system. In addition, chapter 11-21 sets forth requirements for maintenance, prohibits bypassing, and it provides for state inspection. Chapter 11-21 also provides, however, for county ordinances to preempt state and backflow requirements in the case where the Department of Health has approved in writing, the county ordinances. (The Department of Health has approved the cross-connection and backflow prevention ordinances for all four of Hawaii’s counties.) In general, these ordinances require the placement of approved backflow prevention devices in specific locations whenever activities treat, handle, manufacture, or use any liquids, chemicals, or waste products which may be
pollutional, dangerous to health, or have a non-potable auxiliary water supply. Further they require approval.

As a guideline, you should use the most stringent backflow prevention devices whenever there appears to be a conflict between requirements. The air gap is the most effective backflow prevention device. In cases where it is not possible to use an air gap, and approved reduced pressure principle backflow prevention device is generally acceptable.

There must be no chance of creating a backflow into the original water source.

National Pollutant Discharge Elimination System

The federal Clean Water Act (see above) extends the power of the EPA to the states. It allows states to control pollutants released into state waters by issuing permits. These permits carry the weight of both state and federal law. In Hawaii, NPDES permits are issued by the Clean Water Branch, Environmental Management Division of the Department of Health. Their purpose is to assure that the state’s ambient waters (ocean, streams, rivers, lakes, and bays) meet Hawaii’s water quality standards. The Department of Health is responsible for setting all of Hawaii’s water quality standards. As a chemigator, you must answer to HDOH Clean Water Branch if you pollute state waters.

Examples of Unsafe Practices

The following practices are unsafe and should never be used:

- Injecting a pesticide into an irrigation system on the suction side of the irrigation pump.
- Directly connecting an irrigation system to a public water system when applying a pesticide without using a backflow prevention device. (This is not only unsafe; it is also illegal.)
- Chemigating without effective safety devices in place.

Use the equipment and techniques described in Unit 5 (Backflow Prevention) to avoid polluting the water source.

Integrated Pest Management (IPM)

Integrated pest management (IPM) is an ecological approach to pest control. It involves the use of all available tactics to manage pests below an economic threshold level. Most important, it combines all of the most effective pest control strategies into a unified, site-specific plan. This plan may include cultural, mechanical, and biological control methods as well as chemical ones. Before you use a pesticide, always consider viable nonchemical control options first.

Chemigation and IPM

Whether you need to control grass mites in corn or Johnsongrass in a pasture, you must first assess what sort of problem the pests pose. This is where scouting comes in. Scouting is the routine, systematic observation of a given area to record important information about target pests. To do this, record the presence of the pest on a site-by-site basis. Inventory each area several times a year if possible. Before you herbigate, for example, you might record these facts:

- name of the pest,
- approximate height (of weeds),
- weed density/stage of growth,
- soil conditions (ex. slope and texture),
- any noxious weeds that will need intensive control, and
- sensitive areas (ex. streams, orchards, public roadways, and schools).

Keep this information on a scouting form. Make a map of the area on which you record data from each scouting trip throughout the year.
If you are chemigating, you have already decided to use chemical control to address your pest problem. It is important to realize, though, that IPM plans may include both nonchemical and chemical methods. IPM focuses on managing causes rather than simply treating symptoms. In the long run, using a variety of methods is often the best way to reduce pest numbers to an acceptable level.

Unit 2 discusses basic factors to take into account before you begin to chemigate. You will learn the benefits and drawbacks of chemigation as well as the main requirements for a successful treatment.