Lesson 5: Chemical Control Methods

This lesson will focus on chemical insect control. The purpose of insect control is to reduce the damage that can result from insect pest activity. Most producers want a level of control that is effective as well as economical. Chemical control is the most widely used type of insect control because it is direct, very effective, target specific, usually economical, practical for commercial production, and easy to buy and apply.

Pesticides

The term pesticide is a general term for any chemical used to kill any pest. These chemicals are designed to kill, control, or prevent pests from causing damage. A pest can be any living thing that competes with humans for food and fiber, or that attacks people directly. Insecticides are pesticides that are specifically made for controlling insects.

When Is an Insects Considered a Pest?

Insects are considered pests when they compete with humans for food and fiber, or attack people directly. Insects are pests when they feed on leaves; tunnel or bore in stems, stalks, and branches; feed on and tunnel in roots; suck the sap from leaves, stems, roots, fruits, and flowers; carry plant and animal diseases or disease agents; feed on and/or feed in seeds and nuts; and feed on and/or feed in humans and animals.

Pesticide Types

Pesticides are classified by the types of pests they are designed to control. The pest for which a pesticide is intended is called the *target pest*. The most common classes of pesticides and their target pests are given in Table 5.1.

Any type of pesticide may effectively control pests other than the desired target group. Most pesticides can kill organisms that are biologically similar to the target pest as well as the target pest. For example, insecticides may kill beneficial insects as well as pest insects.

Mode of Action

Pesticides function in different ways. Attractants attract pests. Repellents keep pests away. Desiccants and defoliants remove or kill leaves and stems. Plant growth regulators stop, speed up, or otherwise change normal plant processes. How a pesticide works is called the *mode of action*. Common modes of action for insecticides are given below.

- ◊ Contacts – Once an insect comes into contact with a contact poison, it dies.
- ◊ Systemics – Systemics are applied to the animal or plant on which the insects are feeding. Once the insects feed on the treated host, they die.
- ◊ Fumigants – Fumigants are gases that kill when they are inhaled or otherwise absorbed by the insect.
- ◊ Protectants – Once applied to plants, animals, structures, and/or products, protectants prevent entry or damage by insects.
- ◊ Sterilants – Sterilants make insects unable to reproduce.
- ◊ Selective insecticides – Selective insecticides kill a particular type of insect without harming other insects.

Table 5.1 – Pesticides and Target Pests

Type of Pesticide	Target Pest
Acaricide	mites, ticks
Avicide	birds
Bactericide	bacteria
Fungicide	fungi
Herbicide	weeds
Insecticide	insects
Miticide	mites
Molluscicide	snails, slugs
Nematicide	nematodes
Piscicide	fish
Rodenticide	rodents (rats, mice)

◊ Nonselective insecticides – Nonselective insecticides kill any insects present.

◊ Growth regulators – Growth regulators prevent immature insects from reaching adulthood.

◊ Biologicals – Living microorganisms, such as viruses, bacteria, and fungi, are applied to a host to cause a disease in the insect feeding on that host.

Methods of Insecticide Application

The key to using insecticides effectively without injuring plants, animals, or agricultural products is to **follow the directions on the label**. Do not use any insecticide product for any purpose for which it was not specified. The methods of insecticide application are described by special terms.

◊ Pre-emergence – Insecticide is applied before crops or weeds emerge.

◊ Preplant – Insecticide is applied before the crop is planted.

◊ Band – Insecticide is applied to a strip over or along each crop row.

◊ Broadcast – Insecticide is applied uniformly to an entire, specific area.

◊ Dip – Dip refers to the complete or partial immersion of a plant, animal, or object in an insecticide.

◊ Directed – In directed application, the insecticide is aimed at a portion of a plant, animal, or structure.

◊ Drench – Drench can mean saturating the soil with an insecticide or the oral treatment of an animal with a liquid insecticide.

◊ Foliar – Foliar refers to applying insecticide to the leaves of plants.

◊ In-furrow – Applying insecticide to or in the furrow in which a plant is planted is the in-furrow application technique.

◊ Over-the-top – Insecticide is applied over the top of a growing crop.

◊ Pour-on – Insecticide is poured along the midline of the back of livestock.

◊ Sidedress – Insecticide is applied along the side of a crop row.

◊ Soil incorporation – Insecticide is applied and incorporated into the soil using tillage implements.

◊ Spot treatment – Spot treatment means to apply insecticide to a small area.

Insecticide Formulations

An insecticide formulation refers to the specific way the product is made. Insecticide formulations have two parts: 1) the active ingredient, which is the chemical that does the work, and 2) the inert, or inactive ingredients, which are the materials that make the active ingredient easier to apply.

There are several common formulations. They are usually made and applied as a liquid, gas, or solid. Each of these has a specific letter abbreviation, frequently used on labels and in recommendations.

Liquid formulations: An emulsifiable concentrate (EC or E) can be mixed with water to form an emulsion in a spray tank. An emulsion is a mixture in which one liquid is suspended as tiny drops in another liquid (such as oil in water). A flowable (F or L) can be mixed with water to form a suspension in a spray tank. A suspension is made by mixing finely divided solid particles in a liquid. A solution (S) is a mixture of one or more substances that are completely dissolved. These ready-to-use formulations are often used on livestock and in barns.

Ultra-low-volume solutions (ULV) are formulations that may contain only the active ingredient itself. They require special application equipment. Aerosols (A) are low concentrate solutions, which are usually applied as a fine spray or mist indoors. Some come in pressurized cans. Liquified gases are fumigant formulations that turn

into a gas when applied. Some have to be packaged in pressurized containers.

Dry formulations: Dusts (D) are made by adding the active ingredient to a fine inactive powder. Dusts must be used dry. Granules (G) are made by adding the active ingredient to coarse particles, or granules, of some inactive material.

Granule particles are much larger than dust particles. Soluble powders (SP) are made from an active ingredient that dissolves when added to water. Wettable powders (WP or W) are made by combining the active ingredient with a fine powder and a wetting agent. A wetting agent is a chemical that causes a liquid to cover a surface more thoroughly. Wettable powders look like dusts, but they are made to be mixed with water. Wettable powders need continuous agitation to maintain in suspension. Baits (B) are made by adding the active ingredient to a substance that attracts insects or is eaten by insects.

The following should be considered when selecting the insecticide formulations for a given job:

- ◊ Life cycle and habitat of the insect
- ◊ Type and density of plants
- ◊ Type of coverage needed
- ◊ Type and condition of the target plant or animal
- ◊ Type of insecticide
- ◊ Formulation
- ◊ Weather conditions
- ◊ Equipment used
- ◊ Cost of the insecticide product
- ◊ Best and safest method of control

Applying Insecticides

Weather conditions play an important part in using insecticides. Although some air movement is helpful, it is not wise to spray in winds. Winds can cause an insecticide dust or spray to be unevenly distributed on the plants and to drift away from target areas. Be cautious about spraying if rain is predicted. The effectiveness of an insecticide treatment may be reduced if rain falls soon after spraying. Cold weather may have the same effect. Check the label for any precautions concerning the weather.

The equipment used to apply an insecticide is very important to the success of the insect control job.

The type of application equipment selected depends on the insecticide formulation. Insecticides may be sprayed, dusted, used in a dipping tank, injected, or mixed with insect food. Liquids are generally applied using some kind of sprayer. Sprayers are chosen according to the size of the area being sprayed and the insecticide formulation. There are several sprayer types.

Hand sprayers: Hand sprayers are best for small jobs around the home or farm. They can be used in restricted areas where a power sprayer is not suitable. They are economical, simple, and easy to use, clean, and store. However, hand sprayers may give an uneven application rate because of hand operation. They do not usually have the agitation and screening needed for wettable powder formulations. They must be shaken often to provide agitation.

Low-pressure field sprayers: These sprayers are usually used for treating field and forage crops, pastures, and fence rows. They are also used to apply fertilizer-pesticide mixtures. These sprayers are equipped with medium to large tanks. This sprayer is more versatile and flexible than the hand sprayer. It can be operated at a low cost. A high volume of insecticide is usually needed to make the most effective use of these sprayers. Low pressure will limit penetration. Agitation is also limited.

High-pressure sprayers: High-pressure sprayers are also called hydraulic sprayers. They are designed to handle high volumes (100 or more gallons per acre) at high pressure (above 100 psi). They are usually used on fruits, vegetables, landscape plants, and livestock. These sprayers are well built for extended use. Mechanical agitation keeps the insecticide mixed. They are expensive to operate because large amounts of water, power, and fuel are needed. With high pressure, the spray drifts easily.

Air-blast sprayers: The output from the nozzle is broken up into fine drops by a high-speed airstream. The insecticide moves with the airstream to the target. These sprayers provide good coverage and penetration. Only low pump pressure is required. They usually have mechanical

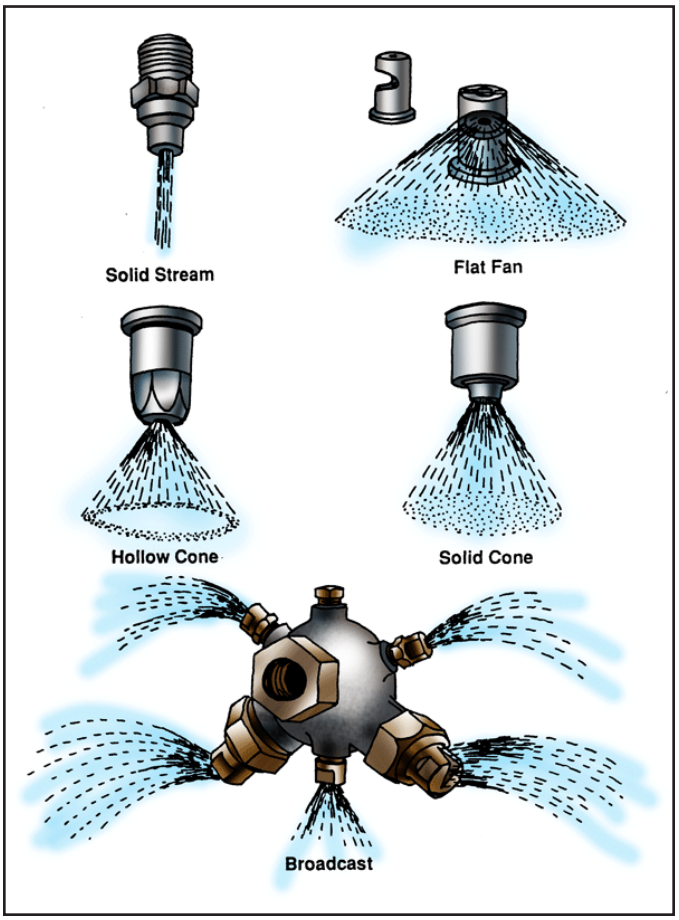
agitation. The sprayer may be difficult to control in small areas. If not properly operated, they may cause an over application of insecticide.

Ultra-low-volume (ULV) sprayers: These sprayers deliver special ultra-low-volume insecticide formulations. High-speed airstreams are used to break up and direct the spray. No water is needed for these sprayers and less insecticide is used. Since no water is used during application, there is a danger of an over application. Care must be taken when applying high-concentration insecticides. Few insecticides can be sprayed this way.

There are five basic nozzle types. See Figure 5.1. Each of these has a special spray pattern. The type of nozzle selected depends on the type of job.

Solid stream: A solid stream is used in handguns to spray a distant target. It is also fixed in a nozzle body to apply a narrow band or inject it into the soil. There is little drift with these types.

Figure 5.1 – Nozzle Types



Flat fan: There are different kinds of flat fan nozzles. The regular flat fan nozzle makes a narrow oval pattern with lighter edges. It is used on booms for broadcast spraying. The nozzles are mounted on the boom so that the spray overlaps 30–50 percent for even distribution.

Solid cone: The solid cone nozzle forms a circular pattern. The spray is well-distributed throughout the pattern. It is used for spraying insecticides at high pressure and flow rates.

Hollow cone: This nozzle forms a circular pattern with tapered edges. Little or no spray is in the center. It is used for spraying foliage. There are two types of hollow cone nozzles: the core and disk nozzle and the whirl chamber nozzle.

Broadcast: This nozzle forms a wide "flat fan" pattern. It is used on sprayers with or without a boom. When attached to the end of a boom, it expands the width of the area sprayed. This provides good coverage for a wide pattern.

Nozzles are made of brass, stainless steel, plastic, aluminum, tungsten carbide, and ceramic. Each type has advantages and limitations.

Sprayer Calibration

For all spraying applications, there are some standard procedures that should always be followed. Always read the operator's manual supplied by the manufacturer. Choose the speed, pumping pressure, and nozzles that you want to use. For thorough and accurate coverage, the insecticide must be applied evenly and accurately. To do this, the sprayer must move at a constant speed when in use. The insecticide must be pumping out at a constant pressure. Each nozzle in the system must deliver the correct amount of insecticide. The nozzles must be of the correct type and size. All of the nozzles need to be the same kind. Each nozzle must be clean and mounted at the right height.

Calibrating a sprayer simply means to adjust the equipment so that the desired rate of insecticide can be applied. This is very important to make sure that each insecticide is used as directed on the label. Too much insecticide is dangerous, costly, and wasteful. Too little insecticide will not do an effective job. The best results are safely obtained by calibrating correctly.

There are many ways to calibrate a sprayer. The methods selected will depend on the equipment used and personal preference. Refer to University Extension Guide Sheets for additional information on calibrating sprayers.

Summary

Pesticides are chemicals designed to kill, control, or prevent pests from causing damage. A pest can be any living thing that competes with humans for food and fiber, or that attacks people directly. Selection of a particular insecticide depends on the needs of the producer, the type of insect, the mode of action, and the formulation of the insecticide. There are a variety of sprayers and nozzles available for applying insecticides. Equipment is selected depending on the formulation and application instructions of an individual chemical.

Calibrating a sprayer is very important for safe and effective use of insecticides. It is very important to make sure that each insecticide is used as directed on the label. There are several ways to calibrate a sprayer, depending on the chemical formulation, the equipment used, and the preference of the applicator.

Credits

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