Lesson 4: Methods of Control

Insects can be controlled by several different methods. Each of these methods has its own advantages and disadvantages. The methods of control are grouped as biological, cultural, physical and mechanical, and chemical. Usually, an effective insect control program uses a combination of methods, depending on the needs of the individual.

Biological Control

The biological control of pests is the oldest control method available. All creatures in nature have natural enemies that repel, kill, and consume them. If these natural enemies were not here, the world would be overrun with insects. Biological control is the use of naturally occurring bacteria, diseases, fungi, viruses, insects, nematodes, birds, fish, toads and frogs, lizards, snakes, rodents, weeds, and others to control insects.

These methods require that the individual has an extensive knowledge about the insect's life cycle, habitat, and response to environmental conditions. Individual insect types cannot be selectively controlled. Biological control requires a lot of time to become effective and then may be only partially effective. It also requires a knowledge of how the environment will be affected by any particular method. The effects on the environment cannot be very well predicted. Although not all biological control methods are costly, they can be very expensive and labor intensive. At this time, these methods are not practical for commercial agriculture. There are four general areas of biological control.

Natural enemies of the insect: This involves selectively increasing the population of the enemies that destroy a particular insect. Insects, such as the ladybug and the praying mantis, are valued because they prey upon a variety of insects that are considered harmful to producers. This method can also involve releasing a virus or disease that infects and kills a particular insect.

Resistant plant varieties: Plant varieties resistant to insect attacks are developed both in nature and through research programs. These host plants are resistant to insects and diseases.

Crop rotations: Crop rotation is an effective biological control method that is used against certain insects. It involves rotating the type of crop grown in a particular spot so that the same crop is not grown year after year. By changing the host species and the environment, insects are less able to build up their populations. Crop rotation is especially effective where insects are not very mobile. This method works because it disrupts the life cycle of the insect and the alternate crop is not suitable for the insect's growth and development.

Sterilization: Radiation or chemicals can be used to sterilize or to genetically alter insects so that they cannot reproduce. These insects can be released into the environment. The particular insect population is then reduced, because it cannot reproduce. This method seems promising but is not yet practical for normal field conditions.

Cultural Control

Cultural control is the management of insect populations by modifying the environment. A thorough knowledge of the insect's life cycle, habitat, and response to the environment is essential for these practices to be successful. Usually, the goal is the make the environment less attractive or agreeable for insects by using standard agricultural practices. These methods are based on disrupting the physical conditions that favor insect life. It is essential to know which conditions to disturb and when to disturb them.

Cultural control methods are only partially effective and individual insect types cannot be selected out. These methods do not require special machinery or equipment and most are not labor intensive. Common cultural methods include tillage, crop rotation, sanitation, timing of harvesting and planting, and water management.

Tillage: How the soil is prepared affects the temperature, moisture, and physical conditions of the soil. Insects may be killed directly by tillage or indirectly. Insects brought

to the surface are unprotected and can easily die due to exposure or from being eaten. Often, immature insects living in the soil are killed before they can complete their life cycle.

Crop rotation: This is considered a means of cultural control as well as biological control.

Sanitation: This means removing weeds or crop residues where insects might live. Weeds may attract insects that spread to crop plants. Also, weeds and crop residues may keep insects alive between crop plantings. Plowing under or shredding weeds and crop residues can reduce many insect problems.

Timing of harvest and planting: Insects may be active in large numbers only for a brief period of the season. If it is possible, time the planting and harvesting of crops so that crops are not growing when insects are most active.

Water management: Many insects depend on water or soil moisture for proper growth and development. Regulating water sources can help control insects.

Physical and Mechanical Control

The goal of physical and mechanical control methods is to destroy insects directly or to modify the environment so that it is unsuitable for insect pests. Physical methods destroy insects by using the physical properties of the environment. Mechanical methods require machinery or manual operations to destroy insects. Often these methods are used together. These methods are different from cultural methods because special equipment or operations are used in addition to regular agricultural practices.

Physical and mechanical methods can give immediate and noticeable results. However, they may be expensive and labor intensive. Also, they are only partially effective. There is limited application in commercial agriculture and large field operations. A good knowledge of the insect's life cycle and habitat is necessary when using these techniques. Determining the type of physical and mechanical control methods that can be used depends on how an insect responds to temperature, humidity, odors, and light. Physical and mechanical control methods include cold storage of fruits and vegetables, applying heat, flooding insects out with a wash, treating agricultural products with protective gases, burning crop stubble and field edges, and insect traps used with an attractant (such as roach motels, or sticky insect strips).

Chemical Control

Chemical control primarily involves the use of insecticides. Chemical insecticides work very quickly and effectively. Insect control can be managed better with chemicals than any of the other methods. Insecticides can be extremely dangerous to people, animals, and the environment, if they are not applied properly. They may destroy beneficial insects as well as harmful ones, but it is possible to control a particular insect without harming other beneficial insects, humans, plants, or animals. Some harmful insects develop a resistance to insecticides after a few generations, thus causing the insecticide to be useless in their control. Only a general knowledge of the insect's life cycle, habitat, and response to the environment is needed. Chemical control is usually not labor intensive. Chemical insecticides are usually classified by how they are made. The main groups are known as organic, inorganic, botanical, and bacterial.

Organic: These are manufactured materials that consist mainly of carbon, hydrogen, and oxygen. They are the most widely used type. Numerous organics are available. Organic insecticides are classified in three groups.

1. Chlorinated Hydrocarbon – These insecticides, which are also called organic chlorines, are considered long-lasting because once they are used, they affect living things for several years. They do not break down easily in the environment. Examples are DDT, chlordane, and lindane. Chlorinated Hydrocarbon is slowly being replaced by other kinds.

2. Organic Phosphate – These insecticides contain phosphorus. They can be used on food crops because they do not leave harmful deposits on or in foods. They must be handled carefully because they are highly poisonous to man. Parathion and malathion are examples.

3. Carbamate – Carbamates contain groups of nitrogen and hydrogen and can be used to kill most insects. They do not leave harmful deposits on food, but some are harmful to warm-blooded animals. Aldicarb, bendiocarb, carbaryl, and carofuran are examples.

Inorganic: These are usually made from minerals. Many inorganics are used to protect cotton, fruit trees, vegetables, and livestock. Since several of these do not break down easily in the environment, they are being replaced by substances that break down more quickly. Lead, arsenate, boric acid, and sulfur powder are examples of inorganic insecticides.

Botanical: These are made from plants. Plant parts are processed and used as either the active killing ingredient or as an attractant. Nicotine, potenome, and dried pyrethrum flowers are examples.

Bacterial: Bacteria are used to infect insects with diseases. Most insecticides work on a general class of insects, whereas a bacterial insecticide specifically kills one kind of insect. They are used on Japanese beetles and caterpillars.

Summary

Insect control is very important in our society. There are several different methods for controlling insects. These control methods are classed as biological, cultural, chemical, and physical and mechanical. Each of these methods has its own advantages and limitations. Usually, an effective insect control program uses a combination of the methods, depending on the needs of the individual.

Credits

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