Lesson 9: Controlling Crop Pests

Crop pests destroy billions of dollars of crop plants each year. Pests also spoil billions of dollars of stored crops each year. Controlling crop pests is a major field of study in agricultural research. Methods and practices have been developed that reduce the damage caused by pests. This lesson will present common methods of crop pest control.

Pests

Most consumers consider the term pest to mean an insect. However, to crop producers, the word pest takes on an expanded meaning. Pests that affect plant growth may include weeds, insects, and plant diseases. Plant pests are organisms that inhibit or prevent plant growth.

It is a good crop management practice to prevent plant pest damage before it starts. However, in some situations, it is necessary to reduce the effect of plant pests after some damage has begun. Methods of control vary, depending on the type of pest.

Weed Control

Control methods for weeds include hand, mechanical, chemical, and biological methods. Hand methods involve pulling weeds out by hand or hoeing weeds out with hand tools, which is extremely effective. However, this method cannot be done on a large scale. Mechanical methods are similar to the hand method, except it is completed using tractors and cultivation equipment.

Chemical methods involve the use of chemicals to control plant pests. Herbicides are used to control weeds with minimum damage to crop plants. Selective herbicides are designed to destroy specific plants based on how crops and weeds absorb and break down chemicals. Selective herbicides may be used to control broadleaf weeds (e.g., cocklebur, mustard) that are growing among grasses (e.g., corn, oats). The amount of herbicide used must be closely monitored to avoid injury to crop plants.

Biological methods are also used to control weeds. Biological control is growing in popularity because of the concern for the environment. In nature, there are specific insects, weeds, and diseases that inhibit the growth of other insects, weeds, and diseases. Researchers in this area continue to discover means by which biological control can be used to control pests in crops.

Insect Control

Insects vary in the way they damage crop plants. Some insects chew on plant parts. Others suck the juices or bore into the plant. Because of these differences, methods of control must also vary. Methods used to control insects include genetic, cultural, biological, and chemical practices.

Genetic control involves the development of cultivars (variety within a species) of crops that are resistant to common insects. One example is the wheat stem sawfly. The wheat stem sawfly attacks the hollow stem of wheat. Crop researchers discovered that wheat varieties with solid stems were not attacked by the sawfly. Plant scientists have manipulated the genetic makeup of hollow stem wheat varieties by incorporating genes that produce a solid stem. From this work, a wheat variety was developed that has the good characteristics of hollow stem wheat combined with the solid stem. Therefore, the sawfly does not attack this new variety. This genetic method to control the wheat stem sawfly has proved to be successful.

Cultural control methods involve the modification of production practices. Examples of cultural control include crop rotation to break the reproductive life cycle of insects or adjusting planting and harvesting dates to break the life cycle of insects.

Biological control may use predator insects to inhibit plant damaging insects. Genetically sterile, mutant insects may be released to spread through the population of harmful insects and reduce their reproductive potential. Other biological controls involve releasing a disease into an insect population which in turn infects other insects. Such biological control methods must be carefully monitored to prevent the introduced insects from becoming pests.

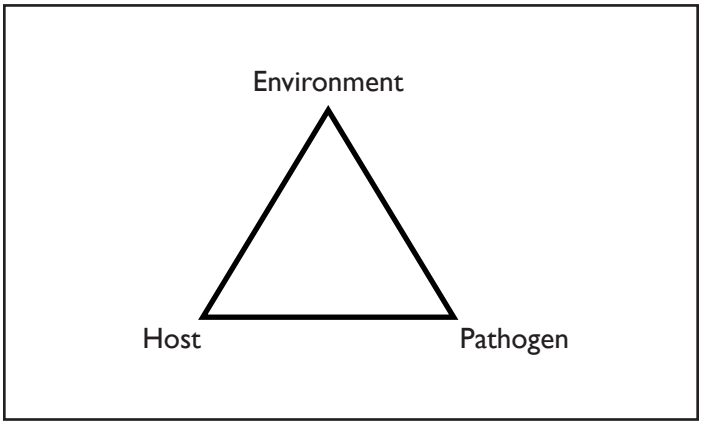
Chemical control involves the planned use of insecticides to combat insects in crop plants. Insecticides are applied

in the form of sprays, dusts, and gases. Chemical methods of insect control must be closely monitored to protect the environment and human health.

Disease Control

Crop yields can be reduced due to plant diseases. Plants are subject to many diseases. In order for a disease to start, three conditions must be present: a suitable environment, a viral pathogen (organisms which produce disease), and a susceptible host. This relationship of three factors is referred to as the disease triangle. See Figure 9.1.

Figure 9.1 – Disease Triangle



Plant diseases are usually caused by fungi (plural for fungus). Fungi do not contain chlorophyll. Because fungi have no chlorophyll, they depend on green plants for food. Damage to plants by fungi can involve the entire plant or localized areas. Methods of controlling fungi are genetic, cultural, chemical, and isolation.

Pesticide Safety

There is wide concern in the U.S. for the environment and human health. The use of chemicals in crop production is under scrutiny. In 1988, over 820 million pounds of pesticides were used in the U.S. Over 6 billion dollars were spent on chemicals to control insects, weeds, and diseases. Considering the volume of use, individuals applying pesticides should be trained to use them properly.

Care must be taken when working with pesticides. Safety procedures should be followed when handling and applying pesticides. Some general safety rules are as follows:

1. The applicator should be trained in pesticide application.
2. Carefully read and follow pesticide label directions.
3. Understand toxicity ratings, signal words, and symbols.
4. Wear appropriate protective clothing and use protective equipment.
5. Store pesticides properly.

Toxicity ratings, signal words, and symbols should be read and understood. These ratings are based on LD50 (lethal dose) and LC50 (lethal concentration) values. The LD50 and LC50 ratings refer to the amount of chemical that is required to cause death in 50 percent of a test population of laboratory animals. The lower the LD50 value, the more toxic the pesticide. Word labels such as "DANGER–POISON," "WARNING," and "CAUTION" relate to the relative hazard of the pesticide to the handler.

Using special protective equipment and clothing when handling pesticides is very important. The human body can absorb some pesticides very quickly. Pesticide absorption through the skin is known as dermal absorption. For protection, the following safety equipment should be worn when using pesticides: clear face shield, goggles, rubber gloves, respirator, boots, wide-brimmed hat, rubber apron, and lightweight coveralls.

Proper storage of pesticides is critical to minimize the risk of accidental poisoning. Improperly stored pesticides are a safety hazard. Storage areas should be well-ventilated, locked, fireproof, and properly marked. Each pesticide should be stored separately and on different shelves. Do not place pesticides in unmarked jars or soda bottles. Keep labels in good condition, on the original container, and keep records of pesticide applications.

Environmental concerns about the use of pesticides have brought about many changes. Awareness of the risk to

human health and the environment has prompted the Environmental Protection Agency (EPA) to restrict the use of some chemicals. Use of pesticides on food products must follow strict guidelines to limit chemical residues. Most pesticides are expensive, and improper application can be very costly. Because of the concern for safe food, care should be taken to use pesticides safely.

Integrated Pest Management

Integrated pest management (IPM) is a technique of controlling pests using multiple pest control practices. IPM is used in agriculture by establishing levels of "acceptable" and "not acceptable" pest infestation in a crop (economic thresholds). Once these economic threshold levels have been established, they are used to determine the need for pest control treatment. Below the economic threshold, control measures cost more than the economic loss caused by the pest. Above the economic threshold, the loss caused by the pest exceeds the cost of controlling the pest.

IPM strategies focus on key pests and their biological characteristics, including weaknesses, crop biology, and the relationship between a crop and its ecosystem. Techniques of manipulating ecosystems by introducing pest-resistant cultivars and the establishment of economic thresholds have been very successful. Using crop scouts, data can be collected to match the method of control with the particular pest, crop, and ecosystem.

IPM involves the use of a variety of regulatory control techniques. Regulatory control measures are designed to prohibit the spread of pests into uninfested areas. Regulatory control includes the use and enforcement of quarantine or isolation techniques. IPM researchers are working toward the development of disease-resistant cultivars for commercial use. Other control techniques used in IPM are biological, cultural, physical, mechanical, and chemical control. IPM is effective in controlling crop pests. By conducting research on pests, crops, and their relationship with the ecosystem, greater control can be achieved.

Summary

Controlling crop pests involves controlling weeds, insects, and diseases. Control can be achieved by means of hand and mechanical methods as well as genetic, cultural, biological, and chemical methods. Chemical control has become the most common method of controlling pests. However, it has become the most controversial because of the potential hazards to human health and the environment. Safety is very important when using chemicals.

Another technique used in crop pest control is the integrated pest management (IPM) system. IPM utilizes professionals in entomology, pathology, agronomy, and horticulture. These experts collect research data on pests, crops, and their relationship to the ecosystem. IPM works to control crop pests by combining multiple control techniques.

Credits

Chapman, S.R.; L.P. Carter. *Crop Production: Principles and Practices*. San Francisco: W.H. Freeman and Co., 1976.

Cooper, E.L. *Agriscience: Fundamentals and Applications*. Albany, NY: Delmar Publishers, Inc., 1990.

Delorit, R.J.; L.J. Greub; H.L. Ahlgren. *Crop Production*. 5th ed. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1984.

Fridline, C.R. *Field Crop Nutrition*. The Ohio State University: Ohio Agricultural Education Curriculum Materials Service, 1978.