

Lesson 7: Integrated Pest Management

Agriculturalists are always looking for ways to produce food and fiber with a quality and in the quantity the world wants. Buildings, roads, and other structures need to be safe and to last. Health professionals are always looking for ways to keep humans and animals in good health. And this must usually be done at a profit. The job of the entomologist is to manage the huge and diverse insect population so that these goals can be achieved.

IPM

Insect control programs must be developed for each individual situation. There are certain steps which greatly help when developing an insect control program. These steps form an efficient system which is called an *IPM program*. The letters “IPM” are used to refer to two different programs. The general program is called Integrated Pest Management. This refers to any pest control program. If the pest in question is specifically insects, then the letters can stand for Insect Pest Management.

Why IPM is Important

The basic goal in insect pest management is to prevent insect populations from reaching a level that can cause substantial damage to a crop. This is referred to as the *economic injury level (EIL)*. The economic injury level is the amount of damage insects do to a crop that equals the cost it requires to use measures that suppress the insects. Insect suppression measures have different functions. Some are designed to prevent the insect population from increasing. Others work to reduce the population already present. Still others work to prevent a particular insect population from becoming a problem in the first place.

Economic Threshold

It is not always necessary to start insect control measures when insects are seen on a crop. The *economic threshold* is used to determine when insect control measures should be considered. The economic threshold indicates the level of damage done by an insect that is used to warn the agriculturalist of potential problems. To determine when the economic threshold is reached, careful sampling

must be done. This may involve counting the actual number of individual insects per unit. Other methods used involve some form of removal, trapping, visual estimates, or assessing the amount of plant damage. When the economic threshold is reached, it is necessary to use methods to keep the insect populations from reaching the economic injury level.

Steps in an IPM Plan

Once it has been determined that insect control measures need to be considered, an IPM plan can be developed. There are specific steps in developing an IPM plan.

Identify the problem: Never try to control a problem until you are sure what it is. Identifying the cause of a plant problem or symptom correctly can be very difficult. There may be many reasons why a plant is not growing properly. For example, plant leaves may turn yellow because of insect attacks, plant diseases, nutrient deficiencies, or herbicide injury. Insects may be the indirect cause of poor plant health. A plant that is already nutrient deficient tends to attract insects. The insects are not the direct cause of the problem, the nutrient deficiency is. Even if the insects are eliminated, the plant would not recover until the nutrient deficiency is corrected.

Identifying the problem incorrectly may cause the wrong method of control to be selected. This not only wastes money but probably will not fix the problem as well. In fact, the real problem will usually get worse. Determining the reason(s) for plant problems in a field environment is often very challenging. It takes an experienced and well-trained individual to find the correct answers.

If an insect problem has been identified, and you know how the insect grows, how it spreads, and what damage it does, you can begin to plan how to control it. Using an insecticide is one of many ways to control pests. The use of a combination of methods is basic to all pest control. Be sure to think about what other methods might work before you decide to apply an insecticide. You can minimize insect problems by:

- ◇ Encouraging the growth of insects' natural enemies
- ◇ Planting crop varieties that resist insects

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- ◇ Destroying crop residues
- ◇ Practicing good fertilizer and manure management
- ◇ Good management of the selected tillage system

Assess the damage: In addition to finding the root cause of the problem, it is very important to determine exactly how extensive the damage may be. Plants have a remarkable ability to recover from insect attack. Some injuries are only on the surface. Even though it may look bad, the crop is not damaged to the point of economic losses. For example, a 5 percent or 10 percent leaf loss appears very damaging, but most plants can grow out of it. On the other hand, small insects and soil insects may not be noticed and yet can be responsible for significant plant damage.

The stage of development of the plant and insect is another point to consider. When assessing plant damage, there is no substitute for a knowledgeable person. It can be very expensive and unnecessary to start measures to suppress or contain insects that may not be causing real damage.

Prepare cost/benefit analysis: A cost/benefit analysis can be difficult to do. A cost/benefit analysis means comparing the cost of an insect control plan with the benefits that the control plan will give. The value of the increased crop yield should be equal to, or higher than, the cost of the actions taken to control insects. The benefits include the short-term value of increased crop yield as well as the long-term value of keeping the insect population under control for the rest of the growing season and following years. Often, it is possible to control an insect population by suppressing the first generation. Later in the season, the number of insects may be greater and more difficult to control. You also need to consider what effects control measures may have on beneficial insects. Lowering the beneficial insect population can increase the harmful insect population and increase control costs overall.

Insect control is necessary only when the insect is causing more damage than is reasonable to accept. Even though an insect is present, it may not do much harm. It could cost more to control the insect than would have been lost by insect damage.

Select a management strategy: There are many insect management strategies to choose from. You need to consider the various factors that influence the selection of a plan. These include:

- ◇ Present crop
- ◇ Cropping system
- ◇ Tillage system
- ◇ Life cycle and habitat of the harmful insects
- ◇ Life cycle and habitat of the beneficial insects
- ◇ Kind of damage that the insect causes
- ◇ Type and condition of the plants or animals under attack
- ◇ Time of year
- ◇ Environmental conditions
- ◇ Geographic location
- ◇ Cost of insect control
- ◇ Goals of the producer

The most common strategies are planting pest-resistant crop varieties and applying insecticides. These measures are used because they are effective, easily available, economical, and in general, can be used easily by anybody. Other strategies include crop rotation, biological control, and modifying the planting time. However, these measures may not be as efficient or effective. They also require a greater knowledge of entomology and pest management.

Implement the management strategy: When selecting a management strategy, a major factor is the ability to actually put it into action and see it through to completion. There are many strategies and alternatives from which to choose. One who is devoted to biological control may be unable to implement it effectively or efficiently. On the other hand, some people are all too ready to employ chemical control exclusively because the materials are readily available. An experienced individual will consider a variety of measures for any particular situation or problem.

Planning is essential for an insect management plan to be successful. Many cultural and biological controls need to be implemented before or during soil preparation and crop planting. For example, a crop rotation, soil insecticide, or choice of insect resistant seeds needs to be made in advance.

It is not always necessary to plan for the worst. Insect populations can be watched and sampled throughout the growing season. Remember that a few insects do not mean a crisis is at hand. When insect damage is noticed, begin monitoring the damage. Now consider the plant growth, the remaining growing season, the climate, and the insect's life cycle. The insect population may not be causing substantial economic damage, or the crop may not be seriously injured. With this information, an appropriate strategy can be made to determine if control measures are needed at all, and if so, how much should be spent on them.

Follow-up of the plan: Following up on a regular basis is an important part of any insect management program. The effectiveness of the measures selected can be judged only by carefully watching the insect populations and crop growth. This can be done through regular sampling. We cannot assume that an insect problem has been thoroughly controlled just because the control measures have been put into action. Control measures may need to be alternated, modified, increased, or decreased as the growing season progresses. Keeping careful records will give a great deal of information on how well the selected plan is working and how efficient and effective the measures are.

Crop Calendars

Most IPM programs begin by focusing on the crop. From there, other factors are added to give a better perspective on the situation. Making a crop calendar is a good way to evaluate any possible problems and different insect control plans. See Figure 7.1. A crop calendar is an outline of the crop's growing season. It provides a systematic and efficient way of looking at the components in a cropping system. Management decisions are easier to make. The basic steps in developing a crop calendar are given below.

1. Set up a table with the 12 months across the top. The left column will indicate crop information such as the following: crop growth stages, insects (be specific), tillage operations, fertilizer applications, herbicide applications, and harvesting.

2. If different insect stages affect the crop at different times, indicate what stage the insect is in and when it causes damage.
3. Indicate the period when insects are most likely to be present and when populations are most likely to cause economic damage.

Now, look at the crop calendar to see when each particular insect will most likely cause the most damage. Look at the growth stage of the crop at this time and think about the following questions.

- ◇ Is the insect attack happening at a critical time in the growth of the crop?
- ◇ Will the crop be able to grow out of any damage?
- ◇ Can the insect damage be prevented?
- ◇ What insect control measures can be used?
- ◇ What are the advantages and limitations of each of these methods?
- ◇ How much insect control is needed at this time, considering both the growth stage of the crop and the insect's life cycle?
- ◇ How will each of the methods affect the rest of the crop calendar?
- ◇ How much will it cost?
- ◇ When should the selected measures be started?
- ◇ What other factors should be considered in selecting a management plan?

With this information, it is easier to evaluate a potential problem and make a decision. There is no "right" or "wrong" choice in selecting control methods. Each situation is different. Only with practice will an individual become a knowledgeable and experienced insect manager.

Summary

There are many factors to consider when developing insect control plans. The individual plan selected will be different for each particular situation.

Crop calendars provide a systematic and efficient way of looking at the components in a cropping system and evaluating different possible control plans.

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Figure 7.1 – Sample Crop Calendar for Corn

Crop Information	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Crop Growth Stages				Seedling	Knee-high	Whorl	Tassel	Silk, Dent, Dough	Maturity			
Insects												
Cutworms				***XXXXXXXX***								
Corn Flea Beetle				**XXXXXXXX*****								
Corn Leaf Aphid						*****XXXXXXXX**						
Corn Rootworms						larvae **XXXXX***XXXXX*****	adults					
European Corn Borer		eggs 1st generation larvae 2nd generation larvae			*XXXX*	**XXXXXXXX**		**XXXX**				
Tillage Operations												
Fertilizer Applications												
Herbicide Applications												
Harvesting												

* – Period when insects are most likely to be present.

X – Period when populations are most likely to cause economic damage.

Credits

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