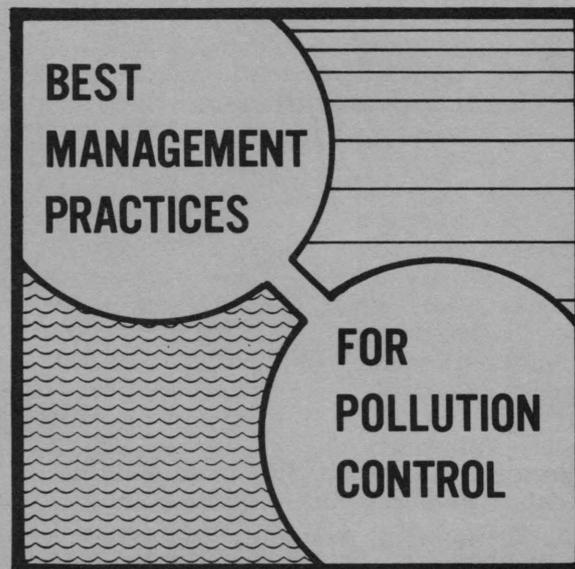


Integrated Pest Management - A Best Management Practice



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INTEGRATED PEST MANAGEMENT - A BEST MANAGEMENT PRACTICE

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Integrated Pest Management — A Best Management Practice

Introduction

Farm chemicals are a major tool for pest control in the agricultural community. Public awareness of pesticide usage and the attendant risk of contaminating water resources has put pressure on farmers using these chemicals. Legislation has been enacted to emphasize cleanup of the environment with improved pest management practices. This concern is reflected in the passage of the Water Pollution Control Amendments of 1972 and the Clean Water Act of 1977. Section 208 of these acts requires planning for the control of both point and nonpoint sources of pollution. (The planning activities are described more fully in the publication, "Best Management Practices in Agriculture and Forestry," Publication 4WCB1, January, 1980.)

Water pollution resulting from pesticide usage is classified as nonpoint source pollution. Nonpoint source pollution is usually associated with storm runoff or seepage into groundwater.

Many pest management practices are common-sense measures already being used by farm managers. However, new concepts are being put into practice that are worthy of consideration.

Integrated Pest Management or IPM emphasizes the use of naturally occurring controls to manage pest populations. For example, Virginia growers are finding it possible to avoid corn earworm damage on soybeans by manipulation of planting dates and row spacing. IPM is not a technique for total eradication of pests nor does it replace chemicals. It can, however, significantly reduce the amount of chemicals needed in the farmer's pest management program.

What Is Integrated Pest Management?

Simply stated, IPM is a program of combining appropriate chemical, cultural, and biological control tactics to suppress pest populations below the level that will cause economic damage to a crop.

How Do Chemicals Affect Water Quality?

Wind drift, storm runoff and percolation all can transport applied chemicals into water. These chemicals may contaminate sources of water for human consumption or accumulate in fish or shellfish used as human food sources. Water used for food preparation, drinking or recreational activities may be adversely affected by agricultural chemicals.

Why Integrated Pest Management?

With IPM, crop pests can be controlled economically while limiting environmental damage. Virginia farmers are netting top returns on some crops by carefully combining available control methods into a unified program for pest management. Economic survival of the farm business may hinge on broadening the management base. Farmers are faced with increasing fuel costs, crop pests, and increased regulations on chemical usage. Progressive farm managers are responding by turning to Integrated Pest Management or IPM.

The Philosophy of IPM Is to:

- (1) Create unfavorable conditions for pest buildup.
- (2) Protect natural enemies that aid in controlling a pest population.
- (3) Detect pest problems early by regular field scouting.
- (4) Apply pesticides only when necessary for maximum effectiveness.

Traditional vs. IPM

The traditional approach to pest control has been:

- Treat when a pest is detected, regardless of numbers or incidence present.
- Treat when a neighbor or respected friend treats.
- Treat when custom sprayer is available.
- Treat based on a fixed calendar schedule or at a traditional time.

However, with IPM the considerations are:

- Treat only if economically threatening levels of pests are present.
- Seek cultural and biological management alternatives to prevent crop damage.
- Consider long term versus short term goals.
- Ask, "What are the harmful effects of a pesticide application on spiders, wasps, lady beetles, or others that feed on crop pests?"
- Treat with the lowest effective rate of pesticide.

Making Integrated Pest Management Work.

IPM combines chemical, cultural and biological practices based on sound scouting programs to manage pests more efficiently than traditional methods. Cultural practices are often referred to as exclusion methods since they can prevent pest populations from reaching levels that are injurious to crops. Some examples are:

Cultural Practices

1. Planting dates - Pests may be manipulated by using knowledge of which pests attack early planted and late planted crops. Mexican bean beetles are the primary pest attacking early planted soybeans, whereas corn earworms are the primary pest of late planted soybeans.
2. Variety selection - Varieties resistant to or tolerant of (capable of enduring) pest attack without excessive damage can suppress pest populations and their resulting damage. Corn varieties resistant to southern corn blight are commercially available to farmers.
3. Row spacings - Female corn earworm moths lay eggs (oviposit) only on widely spaced or open canopies of foliage. Rows for late planted soybeans should be more closely spaced than early planted beans to produce closed canopy foliage (Figure 1). Thus, corn earworm larvae may be occasionally suppressed or excluded by creating conditions undesirable for egg laying.
4. Crop rotation - Black shank disease of tobacco, granville wilt, root knot and cyst nematodes, black root rot and mosaic are controlled by crop rotation programs. Head smut of corn and sorghum may be controlled in part by rotation. Crop rotations not only assist with disease control but also aid in weed control. Seeds of cocklebur, fall panicum, jimsonweed, morning glory, and pigweed tend to build up in fields under continuous soybean production. Using corn in a rotation program readily controls these weeds by reducing the build-up of weed seeds. Corn serves as a smother crop to provide weed control (Figure 2). Four-



Figure 1. Row spacing as a Best Management Practice for control of corn earworm on late planted soybeans. Closely spaced rows (top) produce a closed canopy of foliage at flowering not preferred by female corn earworm moths for egg laying sites. Rows widely spaced (bottom) produce open canopy foliage conducive to egg laying by female corn earworm moths.



Figure 2. Corn planted in a rotation program as a smother crop to provide weed control.

year rotations between closely related crops should be used where possible. Only certified weed-free seeds should be planted.

5. Laboratory analysis - Growers can submit soil samples to VPI&SU's Nematode Advisory Program for determination of the population of harmful nematodes. Based on the assay, recommendations are made on whether soil treatments should be carried out or can be safely omitted.
6. Weather monitoring - A weather monitoring advisory program has been initiated in Virginia that stresses spraying when weather conditions are most favorable to disease development. For example, *Cercospora* leafspot of peanuts has been controlled thus far by calendar spraying (every 14 days) with fungicides. Under the weather monitoring program, a grower will treat only during periods when relative humidity is greater than 95% and the temperature is above 70 degrees Fahrenheit. By spraying only during weather conditions that favor disease development, growers may omit unnecessary treatments for *Cercospora* control.
7. Trap crops - Crops may be planted to attract and concentrate an existing pest population. For example, a few rows of snap beans planted earlier than soybeans will attract and concentrate populations of Mexican bean beetle adults as they emerge from overwintering sites. Once the pests are concentrated, pesticides can be used more efficiently.
8. Sanitation - Crop residues provide harborage for insects, diseases and rodents. Destruction of stalks and rubble is encouraged where erosion is not a problem. Weeds serve as alternate hosts for crop diseases in addition to competing for water, nutrients, and light.

Biological practices:

1. Existing populations of beneficial organisms can be encouraged with proper management. Spraying too early for corn earworm on soybeans will kill the natural enemies that may prevent buildup of the earworm population. Pesticides should be applied only when necessary and at the lowest effective rate.
2. Natural enemies of established pests can be introduced. An annual release of wasps native to India has resulted in five-fold

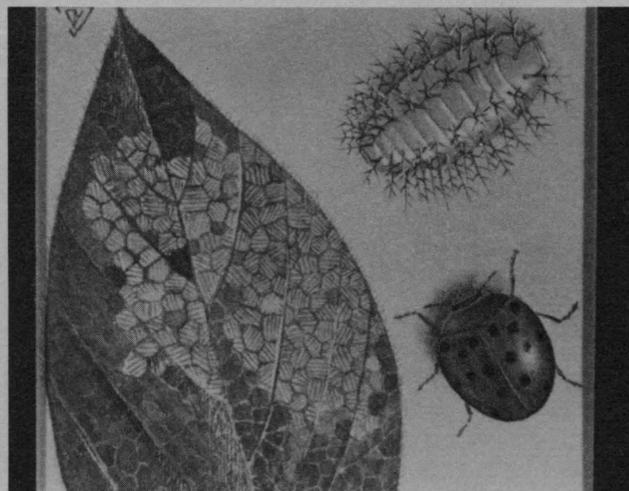


Figure 3. Top: Mexican bean beetle adult and larva [spiny back] and soybean leaf damaged by feeding of the beetles. Bottom: Microscopic photo of Indian wasp [*Pediobius foveolatus*] laying eggs between spines of Mexican bean beetle larva. Wasp photo courtesy of A. L. Steinhauer, University of Maryland.

reduction in damage from the Mexican bean beetles to crops in Virginia. The wasp (Figure 3) attacks and kills larvae of Mexican bean beetles by laying eggs in living bean beetle larvae.

3. Disease agents such as *Bacillus thuringiensis* are commercially available for controlling the caterpillar stages of some crop insect pests. Natural diseases of pests are specific for target pests and generally do not harm existing natural enemies which aid in the fight against target pests.

Scouting programs.

Sound scouting programs are vital for successful management of pests in agriculture. Trained scouts monitor, sample, and survey fields for pests including weeds, insects, and diseases (Figure 4). In addition, populations of beneficial insects such as natural pest enemies are monitored. Scouting data not only provide knowledge of pests present but may also serve as a basis for predicting future pest populations.

Chemical controls.

For rapid control, chemicals are the most effective and efficient method to use against damaging pest populations. They may provide protection when management fails to suppress pest populations below economically threatening levels. Used carefully, chemicals can provide cost effective control of pests while causing only limited environmental contamination. They pose the disadvantages of added costs, hazard to the applicator, and contamination of land and water. Destruction of wildlife and natural enemies of crop pests may also occur with chemical application. Repeat applications of chemicals are usually necessary, as opposed to natural controls which may be self-perpetuating strategies.

To be cost effective, man-made controls must relate to the economics of the crop, as well as the pest population. Below a certain pest population, the cost of treatment exceeds the dollar loss caused by the pest. In fact, sometimes it is important to maintain very low pest populations to keep a healthy population of beneficial insects. The pest population at which the dollar damage equals the cost of control is defined as the ECONOMIC INJURY LEVEL (Figure 5). This level changes with the growth stage of the crop, the market, and other factors. The pest population in the field is determined by scouting and results are compared to the economic injury level to make a decision whether a treatment is cost effective.

However, there is often a time lag in information transfer and treatment in the field. Thus, an ECONOMIC THRESHOLD (Figure 5) is used as the basis for a decision. This is defined as a pest population lower than the economic injury level. Growth rates of pests are taken into account as is the expected time lag before treatment. Treatment at the threshold level is then determined to prevent populations from reaching the economic injury level.



Figure 4. Trained scouts monitor, sample, and survey fields for weeds, insects, and diseases.

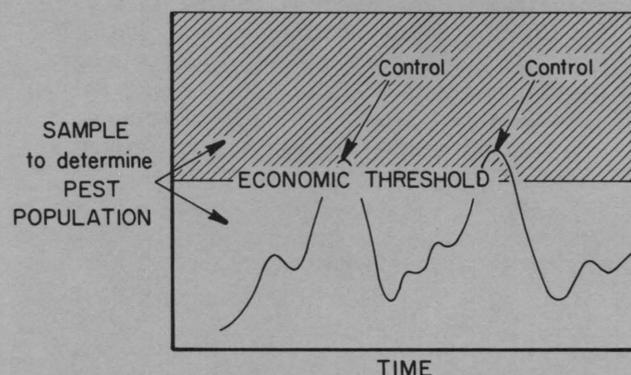
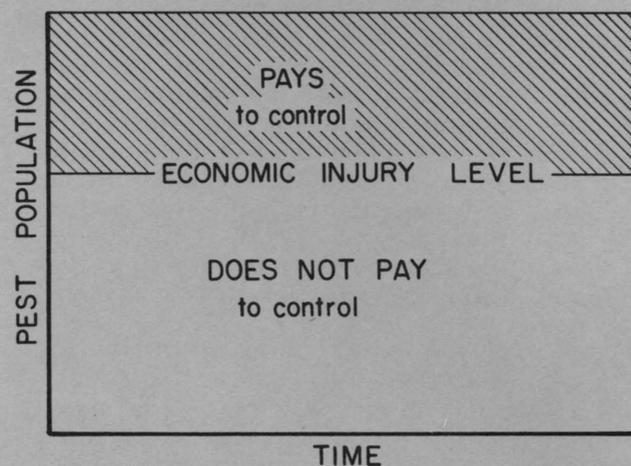


Figure 5. Graphs illustrating pest populations through time and the economics of control. Top: Control actions are not economically justified until the pest population is above the economic injury level. Bottom: In the field, the pest population is determined by sampling. Controls are recommended only when the pest population reaches an economic threshold, a level that is lower than the economic injury level. This allows time for controls to be applied prior to the population reaching the economic injury level.

Applying IPM to Wildlife Problems.

In addition to insects, weeds, and bacterial diseases, farmers may have to contend with flocks of birds, herds of deer, and populations of rats and mice. The IPM philosophy is applicable to these pests also. Because of their size, mobility, and often positive values to society, wildlife may have to be dealt with using different tactics. Wildlife damage is easy to overestimate. Light browsing on soybeans may not reduce a crop significantly. One flock of birds pulling sprouted corn in a field may anger the grower, but the damage may not be great enough to justify control measures. For wildlife, as with other IPM approaches, take action only when economically justifiable.

Take advantage of natural factors that act to reduce populations of problem-causing wildlife. For example, a healthy population of black-snakes will help keep populations of rats and mice in check. No-till corn planting makes the sprouting seeds less vulnerable to birds. Larger fields reduce the damage caused by deer because of deer's preference of feeding within 10-30 yards from protective cover. Changing field size can be expensive, but frequently the larger fields result in marginal increases in machinery and energy efficiencies.

Because wildlife shares physiological characteristics with man, poisons must be administered with deliberate care. Farmers can contact their county extension unit office or the Virginia Tech Wildlife Extension Specialist for guidelines. Help with persistent bird flocks and severe rodent problems can be found at the Bird Control Division of the Plant Pest Control Section of the Department of Agriculture and Consumer Services in Richmond. Extreme problems with deer should be brought to the attention of the Virginia Commission of Game and Inland Fisheries by contacting the county game warden.

Summary.

Integrated Pest Management is not a technique for total eradication of pests nor does it completely replace synthetic chemicals. Instead, IPM emphasizes the use of naturally occurring pest controls including weather, disease agents,

predators, and parasites. Pests can be controlled in an economically efficient and environmentally sound manner. Progressive farmers are realizing benefits of IPM in managing insect pests, plant diseases, weeds, and wildlife damage to crops.

Further Information On Integrated Pest Management

Additional information on IPM is available from your extension agent. Other sources include the Department of Entomology, Department of Plant Pathology and Physiology, and the Department of Fisheries and Wildlife Sciences at Virginia Tech.

Publications Of Interest:

Soybean Insect Pest Management for Virginia, Pest Management Guide 32, Cooperative Extension Service, Virginia Polytechnic Institute and State University;

A Manual for Implementing an Insect Pest Management Program for Soybeans, Department of Entomology, Virginia Polytechnic Institute and State University;

Best Management Practices in Agriculture and Forestry, Publication 4WCB1, Cooperative Extension service, Virginia Polytechnic Institute and State University;

Best Management Practices for Row-Crop Agriculture, Publication 4WCB3, Cooperative Extension Service, Virginia Polytechnic Institute and State University.

Other Publications in this Series:

Best Management Practices for Beef and Dairy Production, Publication 4WCB4;

Best Management Practices for Swine Operations, Publication 4WCB5;

Best Management Practices for Tobacco Production, Publication 4WCB6;

Conservation Tillage - A Best Management Practice, Publication 4WCB7;

Terraces - A Best Management Practice, Publication 390-408.

