

# CONCEPTS OF INTEGRATED PEST MANAGEMENT

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Potato growers who use IPM consider all available pest control tools. Alternatives to conventional pesticides are the foundation of every IPM plan. Pesticides play a central role in potato IPM strategies, but their use depends on first knowing if infestations pose a real threat to crop profitability, and then secondly on the need to manage them in ways that do not interfere with naturally occurring biological control agents or pose hazards to human health or the environment.

## BENEFITS OF USING IPM

- Control pests in ways that maximize the profitability of crop production while minimizing any potential harm to human health or environmental quality.
- Helps producers select and manage pesticides in a manner that can delay or eliminate the development of pesticide resistance.
- Helps maintain long-term quality and productivity of the soil and other resources, helps protect water resources from pesticide contamination, and addresses consumers' concerns about food safety and pesticides.

## HOW TO USE IPM PRINCIPLES

It is important to realize that IPM is a philosophy or way of thinking about pest control rather than a set of standard practices. There are five general principles to implement any successful IPM program.

### **Principle No. 1: No Silver Bullet**

There is no single, best way to control any pest. Over-reliance on any method almost always has undesirable economic or ecological results.

**What To Do:** All available pest control tools should be considered, especially cultural methods and biological controls.

### **Principle No. 2: Treat Causes of Pest Outbreaks, Not Symptoms**

Stop-gap control measures, such as application of pesticides that kill pests after infestations occur, do not solve pest problems in the long run.

**What To Do:** It is essential to learn about pest biology, especially environmental conditions that affect pest invasion and survival.

### **Principle No. 3: Pest Presence Does Not Mean a Pest Problem**

Reduce pests only to levels that do not cause economic damage.

**What To Do:** Pesticides should be applied only if pest infestations exceed action thresholds.

### **Principle No. 4: If You Kill the Natural Enemies, You Inherit Their Work**

Naturally occurring biological control agents help keep many pest populations at levels that are not damaging to the potato crop.

**What To Do:** Learn to recognize common native biological agents.

### Principle No. 5: Just-in-Time vs. Just-in-Case

Pest sampling and forecasting methods determine pest type and number.

**What To Do:** Every field should be regularly monitored (scouted) for weeds, insects, diseases, and nematodes.

## ECONOMIC INJURY LEVELS AND ECONOMIC THRESHOLDS

An IPM program uses economic injury levels (EIL) and economic thresholds (ETH), which are numeric guidelines that identify when pesticide use is needed. The EIL is formally defined as the break-even pest density. The economic threshold is the time to take control action to prevent the pest population from increasing beyond the EIL.

### Non-Economic Pests

Non-economic pests are those that consistently remain below economic levels.

### Occasional Pests

Occasional pests are those species that normally remain below the EIL but sporadically exceed the threshold levels, perhaps 1 year in every 3 or 4.

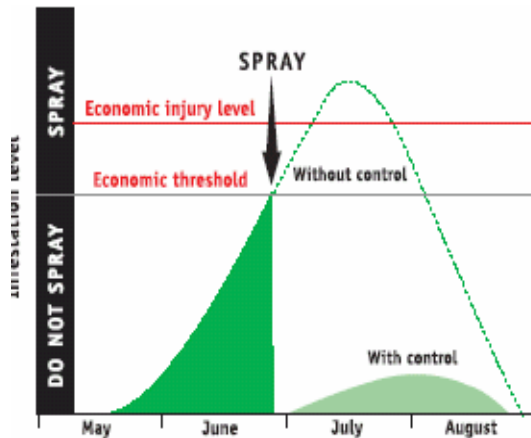


Figure 9.4. Relationship between the economic injury level (EIL), economic threshold (ETH), and seasonal pest population growth. The time to take control action (apply pesticide) is when pest density reaches the ETH value; pesticide application at this time keeps infestations from increasing beyond the

### Severe Pests

Severe pests are the most difficult species to manage. These include many weeds and diseases that occur at high levels every year and cause major damage unless controlled.

## PEST SCOUTING

A key principle of IPM is that pesticides should be used only when field examination or scouting shows that a pest infestation exceeds the economic threshold. Five

rules generally apply when inspecting potato fields for pests.

- Rule 1: Examine Every Field
- Rule 2: Sample Randomly
- Rule 3: Sample Across the Entire Field
- Rule 4: Take Enough Samples
- Rule 5: Keep Records of Scouting Data and Management Actions

## MINIMIZE HARM TO NATURAL INSECT ENEMIES WHEN USING CONVENTIONAL INSECTICIDES

Plant diseases and weeds in potato fields are seldom controlled by natural enemies, but there are naturally occurring beneficial insects that will help keep potato-damaging insects below economic thresholds. When an insecticide is warranted, growers should attempt to conserve as many beneficial insects as possible. Several practical steps can be taken to minimize harm to beneficial insects when insecticides are used. The single most important practice to conserve beneficial insects is to minimize the use of broad-spectrum insecticides. *Please refer to **Potato Production Systems** book for more detailed information about other ways to conserve beneficial insects* ([Order Potato Production Systems](#))

## CULTURAL PRACTICES FOR MANAGING WEEDS, INSECTS, AND DISEASES

An IPM program uses cultural practices to reduce the rate at which pests colonize a field or make the crop environment less suitable for pest survival. These practices are listed below.

### Before Planting

#### ***Field Selection***

Fields should not be planted to potatoes more often than 1 year in 3.

#### ***Soil Moisture***

If the field is dry, a better practice is to irrigate before, not after planting.

#### ***Variety Selection***

Some potato varieties tolerate disease infestations better than others.

#### ***Certified Seed***

The best defense against potato viruses is to plant certified seed.

#### ***Seed Cutting***

Equipment needs to be sanitized at least daily, and preferably more often, to prevent the spread of tuber-borne diseases.

## During Planting

### ***Planting Date***

If at all possible, plant only when the soil temperature at planting depth is at least 45°F.

### ***Correct Depth***

Planting deeper than 6 inches will not only delay emergence, but it will also increase Rhizoctonia development.

## During the Growing Season

### ***Disease Management***

Cull piles and volunteer plants should be eliminated.

### ***Fertility and Irrigation Management***

Vigorously growing plants compete better with weeds and tolerate disease and insect pest problems better than weak plants. For example, plants that are healthy are less likely to be affected by Verticillium wilt or early blight.

## After Harvest

### ***Crop Rotations***

Rotation crops should be planted that avoid the build up of weeds, insects, or disease pathogens that are hard to control in the potato crop.

## OTHER IPM PRACTICES FOR MANAGING CERTAIN PESTS

### **Physical Pest Control**

Physical pest controls are similar to cultural pest control practices. However, physical pest control practices use mechanical devices to exclude or trap-out pests.

### **Biological Control**

Biological control uses natural enemies to suppress populations of pests. *Please refer to **Potato Production Systems** book for more detailed information ([Order Potato Production Systems](#)).*

## SELF-ASSESSMENT CHECK-OFF SHEET

### **IPM Practices for Diseases**

- Follow a 4-year or longer rotation for disease control.
- Plant certified seed.
- Separate each field at least 1/4-mile from neighboring potato fields to limit spread.
- Plant potato varieties for their disease resistance.
- Plant green manure crops to control diseases.
- Rogue out volunteer potato plants in rotational crops.
- Rogue out diseased potato plants.
- Control nightshade and other weeds that are alternate hosts for potato diseases.
- Adjust fertility and irrigation practices to manage diseases.
- Use aerial monitoring or infrared photography to monitor diseases.

- Keep written notes or field maps about disease and nematode problems. Scout fields for late blight to determine need for fungicides.
- Use forecasting models to time fungicide treatments for late blight.
- Follow your state's recommendations for late blight fungicide applications. Destroy cull potatoes to reduce sources of late blight.
- Sort off and remove decayed tubers coming into storage.

### **IPM Practices for Nematodes**

- Clean field equipment to avoid introducing nematodes.
- Alter crop rotations to include non-hosts for nematodes.
- Plant green manure crops to control nematodes.
- Take soil samples to detect the presence of nematodes.
- Apply nematicides only if infestations are greater than economic thresholds.

### **IPM Practices for Weeds**

- Scout the previous crop for potential weed problems.
- Scout potato fields for weeds to determine need for herbicides.
- Keep written notes or field maps about weed problems and herbicide applications.
- Cultivate for weed control.
- Choose rotational crops that compete well with weeds.
- Control weeds in rotational crops.
- Spot-spray weed patches (rather than spraying entire fields).
- Adjust herbicide application rates based on weed infestation levels.
- Rotate herbicides to avoid resistance.
- Clean equipment between fields to prevent weed spread.
- Rogue weeds from potato fields.
- Plant winter cover crops for weed control.
- Control weeds in fencerows and other areas by growing cover crops.

### **IPM Practices for Insects**

- Sample soil for wireworms.
- Use bait stations for wireworms.
- Examine potato leaves for aphids.
- Scout fields for Colorado potato beetle.
- Use economic thresholds to determine need for insecticides.
- Reduce insecticide rates or spot spray to protect ladybeetles and other beneficials.
- Mass-release ladybeetles or other beneficial insects.
- Plant border crops along field edges as habitat for ladybeetles and other beneficial insects.
- Rotate insecticides to avoid resistance.
- Scout fields for ladybeetles and other beneficials.
- Use a test-kit, such as one from the University of Idaho, for Colorado potato beetle insecticide resistance.
- Apply microbial insecticides or Kryocide to control Colorado potato beetle or caterpillars.
- Alter crop rotations for insect control.
- Separate fields at least 1/4-mile to control insects.
- Plant potato varieties that do not express net necrosis.
- Harvest early to avoid net necrosis.

- Choose planting or harvesting dates to reduce insect problems.
- Apply a wireworm insecticide to rotational crops.
- Cultivate to control soil insects.
- Keep written notes or field maps about insect problems and insecticide applications.