

THE KEY COMPONENTS OF IPM

Scouting: Inspect plants for diseases and insects. A hand lens is useful to examine plants. Scouting tools include yellow sticky cards, potato wedges, and indicator plants for early detection of pest problems.



Adult potato aphid.

Record Keeping: Maintain regular records of your pest and disease problems and refer back to them when a problem resurfaces. This helps you prepare for the following year.

Pest Identification: Know the pest or disease on your plants before trying to manage it. Send specimens for identification by experts when you don't recognize the pest.

Prevention: This includes good sanitation, soil and water testing, general maintenance, weed control, proper watering, and purchasing pest-free stock.

Sanitation: Use clean pots and pest-free soil. When possible, leave the greenhouse empty for a short time and sanitize it before starting a new crop. Remove heavily infested plants during the season and discard "pet" plants at the end of the season.

Testing pH and Nutrient Levels: Test potting mix and water for pH and soluble salts. Adjust levels as needed. Send out samples for analysis if necessary.



pH and soil sampling.



Weeds under bench.

Weed Control: Remove weeds under benches as they can harbor insects and disease. Maintain a weed-free border around the outside of the greenhouse.

Watering: Too much or too little water make the plant susceptible to diseases and insect pests. Hang up the hose between watering. The people who water are the first line of defense for insect or pest problems.

Purchase Pest-free Stock: Check 10% of the stock you buy for pests and pathogens and discard infested plants. Return heavily infested plants to the producer.

Biological Control: When possible, use biological controls rather than chemical pesticides.



Natural enemies: lady beetle adult (left); parasite stinging an aphid (right).

Chemical Control: When other approaches fail, chemical pesticides may be appropriate. Follow label instructions. Calibrate your sprayer at the beginning of the growing season and use spray cards to check coverage.

SCOUTING

Scouting is the essential first step of IPM. Early detection of pests, diseases and nutrient imbalances ensures that problems are managed promptly so infestations don't spread and control costs are minimized. Some growers say they don't have time, but the time they spend scouting may save them time and money later.

- ✓ Establish a standard scouting procedure that works for you and do it at least once a week. Procedures may change over the year. More intensive scouting is needed in late spring and summer -- when pests and diseases tend to increase rapidly--than in fall and winter.
- ✓ Colored sticky cards are a common way to monitor flying insects. Most growers use yellow cards because they attract several pest species. Some use blue cards because they are particularly attractive to thrips, but they are not effective for whitefly or fungus gnats. The most common recommendation is 1-2 cards per 1,000 sq. ft. of bench. They are positioned just above the foliage, often attached with a clothespin on a 12-15 in. long stake. One disadvantage of sticky cards is that they also attract beneficial insects, such as parasitic wasps.



Vertical and horizontal sticky cards.

- ✓ Yellow sticky cards can also be rested horizontally on the rim of a pot to catch flying insects as they emerge from the soil (fungus gnats, thrips, and shoreflies).
- ✓ To reduce the cost of sticky cards, you can use one side of the card at a time, leaving the other side covered with a non-sticky paper.

Some growers mark the insects as they count with a marking pen, eliminating the need to replace cards as often. It is best to count the number of each insect species on a sticky card. At least keep track of population trends, i.e., changes in insect numbers on the cards from week to week. The relationship between the number of insects on a card and the expected damage is unclear, and varies with greenhouse conditions and season. For example, whiteflies are more active on warm, sunny days and more likely to appear on the cards than on cool, cloudy days.

- ✓ **BEWARE!** Sticky cards are not 100% effective. In winter, no thrips may appear on the cards, even when they are present. To detect non-flying or crawling pests, a proportion of the plants, selected at random, must also be inspected.
- ✓ In addition to checking sticky cards, walk slowly through the house scanning for damage symptoms like wilted tips, off-color plants, leaf or blossom spotting, and curled or deformed leaves. Inspect plants to determine the cause of the problem.



Plant inspection with a hand lens.

- ✓ When inspecting a plant, look at the entire plant, especially leaf undersides. Some pests congregate at the top of the plant, while others prefer lower leaves. Disease symptoms are often found on the stem or at the base of the plant.
- ✓ Use a 10x hand lens to look for the very small insects. Hold the lens close to your eye and move the specimen to the lens until it is in focus. An optivisor is also a useful tool for scouting.
- ✓ When scouting greenhouses containing one crop, three plants in 10 different areas around the greenhouse should be inspected, looking at upper and lower leaf surfaces. Flowers should be checked by shaking them over your open palm or a white sheet of paper.

- ✓ When scouting greenhouses with several plant species, it is best to inspect 5% of each variety. Some varieties are more prone to insects, diseases and nutrient deficiencies than others, so take special care to inspect the susceptible ones. For instance, lantana needs close inspection for aphids, whiteflies and thrips, while geraniums may only need to be checked for thrips. Lists of susceptible plants and their associated problems are found on pages 44 and 45. Mark any problem areas or plants where a localized infestation or outbreak is found. These areas should be re-inspected regularly to determine if a spot spray is needed.



Tapping plant on to white paper to check for insects.

- ✓ If only a few plants are infested or diseased, it may be wise to dispose of them to avoid a spread of the problem to other plants.
- ✓ Educate your workers about damage symptoms and pests, and ask them to inform you of problems they see. The person doing the watering looks at each plant, so encourage him or her to watch for damage.
- ✓ Indicator plants can also be used to attract pests. These are plants that are highly attractive to both flying and non-flying insects. They can be used together with sticky cards. To be effective, they must be easy to grow, flower year-round, and produce pollen.

In the winter, flowering marigolds and mums were found to attract thrips 2-3 weeks earlier than sticky cards. Early in the season in non-flowering crops, indicator plants must be replaced regularly so they do not serve as a reservoir for pests.



Lemon gem marigold as indicator plant for New Guinea impatiens crop.



Potato wedge in soil.

- ✓ Potato wedges are used to monitor fungus gnats. Pieces of potato (1/4 in. thick, 1 in. long) are pressed into the soil. After 3-7 days, the small clear larvae can be counted, feeding on the wedge (page 22).

Wedges must be changed weekly to prevent rooting, drying out, or allowing larvae to develop. Other soil-dwelling organisms may be found associated with the wedge, such as shorefly larvae, nematodes, springtails and the predatory mite, *Hypoaspis* sp.

- ✓ Recording the results from scouting is as important as scouting itself. Find a system that works for you. A sample data sheet (page 9) is provided, which can be produced as a computerized form so data can be recorded on a hand-held computer device.
- ✓ Experience will teach you what the results of your scouting mean. Over time, pest trends will appear so you will know when to take action to avoid a problem. A few thrips on a card in January may not be a cause for alarm or action, while the same number in April when days are longer and temperatures are higher, may indicate an impending problem that needs immediate attention. Growers who use biological control may want to make releases when a pest is first detected (or even before detection), while those who rely on chemical pesticides may wait longer.

HOW TO DIAGNOSE A PLANT PROBLEM

1. What type of plants are affected?

Knowing the type of plant will narrow the possibilities. Some plants are especially susceptible to a particular pest, disease, or nutrient deficiency. Many reference books organize information by plant type.

2. Are other types of plants also affected?

Some problems are specific to one plant type and others affect multiple plant types.

3. What part or parts of the plant are affected (leaves, roots, stems, flowers)?

Some problems affect one part of a plant, others affect the whole plant. This provides clues to the cause. Are the symptoms caused by a pathogen, disease, insect or mite, nutrient deficiency, or environmental problem?

4. What are the symptoms and is there a pathogen?

Check for symptom patterns such as one-sided, top-only, older versus younger leaves, etc. Symptom patterns provide clues to causes.

5. When did you first notice the symptoms?

You may be able to relate other events, such as weather or changes in production practices, or the arrival of a plant shipment, to the problem.

6. Are there any signs of an insect or disease?

You may see the insect or disease organism (gall or fungal growth). Collect them in a bag for closer inspection or send to a specialist.

7. Check your references to confirm identification.

A list of references and websites are provided at the end.

8. If you aren't sure of the identification, contact a specialist in your region and send them a sample. (See pages 82-84 for the diagnostic laboratory in your state.)

Sample Greenhouse Scouting Form

Date: _____ Greenhouse: _____

Scout: _____

Weather: _____

General Scanning Inspection															
Bench/ Plant Type	Insects and Mites				Beneficials				Diseases & Nutrient Problems						
	FG	SF	WFT	Other Thrips	GPA	Aphids	Other	SM	Beneficials	Other	PM	BO	PY	INSV	Other:
Total															

Sticky Cards															
Bench/ Plant Type	Insects and Mites				Beneficials				Diseases & Nutrient Problems						
	FG	SF	WFT	Other Thrips	GPA	Aphids	Other	SM	Beneficials	Other	PM	BO	PY	INSV	Other:
Total															

Plant Inspections															
Bench/ Plant Type	Insects and Mites				Beneficials				Diseases & Nutrient Problems						
	FG	SF	WFT	Other Thrips	GPA	Aphids	Other	SM	Beneficials	Other	PM	BO	PY	INSV	Other:
Total															

General Comments and Proposed Actions											

Key to abbreviations:

- FG fungus gnats
- GPA green peach aphid
- BO botrytis
- SF shore flies
- SM spider mites
- PY pythium
- WFT western flower thrips
- PM powdery mildew
- INSV impatiens necrotic wilt virus