IPM Scouting and Decision-Making

A regular monitoring program is the basis of integrated pest management (IPM) decision-making, regardless of the control strategies used. By regular monitoring, a scout can gather current information on the identity and location of problems and to evaluate treatment effectiveness. The following are the basics for an effective scouting program.

Essential monitoring tools include:

- Trained personnel.
- Hand lens with 10-20X power and/or Optivisor™ (hands-free magnifier) with similar magnification.
- Dissecting microscope.
- Microscope magnifier clip-on for cell phone camera.
- Yellow sticky cards, bamboo stakes, clothespins.
- Flagging tape or colored flags.
- Record keeping system, i.e. clipboard and pen or small notebook, or computerized system.
- Individual maps of all greenhouses.
- Support labs and on-site diagnostic kits for disease diagnosis.
- Support labs and pH and EC meters for growing media tests.
- Resource information such as pesticide labels, pictures and life cycles of key pests and biological control agents.

Figures 1 & 2: Scout using hands free magnifier (Optivisor™) to inspect sticky cards (on left) and use of pest infested indicator plants (on right – note use of flagging tape). Photos by L. Pundt

Optional Tools Include:

- Potato chunks (to monitor for fungus gnat larvae).
- Soil thermometer.
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Pre-Crop Site Evaluation

One month prior to the introduction of a crop, evaluate the entire greenhouse, inside and out. Note the presence of weeds in and around the greenhouse, drainage problems, algae build-up, overwintered plants, and debris under greenhouse benches.

Review previous pest problems in the greenhouse and current management methods. Prevention of key pest problems is more easily accomplished if the grower and scout take the time to identify, analyze and correct as many issues contributing to pest problems before crops are introduced. For example, keeping seedlings separate from cuttings in propagation houses and vegetable transplants separate from ornamentals helps reduce the incidence of tospoviruses (impatiens necrotic spot virus or tomato spotted wilt virus) when western flower thrips are present.

Inspection of Incoming Plants

At the time of arrival or soon after, the scout should inspect one-third or more of the plants. Thoroughly examine the plants for signs of insects, diseases, and cultural problems. (see table below)

Key Pest/Disease	How to Monitor	Where to Look
Aphids: Foxglove Aphid (*Aulacorthum solani*)	Rely on plant inspection, not sticky cards. Foxglove aphids have two dark spots at the rear of their body.	Look for aphids on the underside of lower leaves. Look for signs of aphid activity: shed white skins, honeydew, and distorted leaves.
Aphids: Green Peach Aphid (*Myzus persicae*)	Rely on plant inspection, not sticky cards.	Look on tips of new growth for 1/14-inch-long green to pinkish aphids. Look for signs of aphid activity: shed white skins, honeydew, and presence of ants.
Aphids: Melon Aphid (*Aphis gossypii)*	Rely on plant inspection, not sticky cards. Aphids are 1/16-inch-long with dark cornicles.	Inspect incoming plant material, on underside of leaves and stems. Melon aphids are more likely found along the plant stem than on the growing tip.
Broad mites (*Polyphagotarsonemus latus*)	These mites are too small to be seen with the naked eye. Look for signs of plant damage. Inspect leaves under a dissecting microscope for eggs that are covered by small whitish bumps that look like a row of diamonds.	Broad mite feeding causes twisted, hardened, and distorted tip growth and bronzed, roughened underside of leaves. Young terminal buds can be killed. Outer leaf edges turn downward. May be confused with leaf distortion caused by thrips feeding or plant growth regulator overdose.
Caterpillars (many different species)	Rely on plant inspection.	Look for chewed foliage and fecal droppings near feeding injury.
Cyclamen mites (*Phytonemus pallidus*)	These mites are too small to be seen with the naked eye. Look for eggs and mites under a microscope.	Look for puckering, crinkling, and curling of leaves. Infested buds may fail to open.
Fungus Gnats (*Bradysia spp*.)	Place some yellow sticky cards flat on rim of pot and others horizontally just above soil surface to capture adults. Use potato chunks in pots to monitor larvae. Examine every 2 days.	Favorable habitats include areas with standing pools of water, mud floors and low growing weeds. Potting mixes high in microbial activity tend to attract fungus gnats.
Two spotted spider mites (*Tetranychus urticae)*	Rely on plant inspection. Look for light stippling, discolored foliage, leaf drop, yellowing and webbing if high	Inspect incoming plants for spider mites, especially on undersides of leaves along the midvein. Monitor susceptible plants in hot, dry areas in greenhouse (i.e. near steam

	populations have developed.	pipes or furnace or in hanging baskets.)
Western Flower Thrips (*Frankliniella occidentalis*)	Rely on sticky cards to monitor for adults. Place cards at bench level, just above crop canopy.	Inspect incoming plant material for adults and larvae by tapping tender new growth and flowers over a sheet of white paper. Inspect and manage yellow flowered weeds.
Whiteflies Greenhouse whitefly *(Trialeurodes vaporariorum)* Sweetpotato whitefly (*Bemisia tabaci)*	Use sticky cards to monitor for adults. Rely on plant inspection to detect immature stages. Use pest- infested indicator plants to assess treatment (biological control agents or chemical) effectiveness.	Older (3rd and 4th) instar immatures are found on lowermost leaves, egg-laying adults on the uppermost leaves. Inspect and remove weeds and unsold “pet plants”.
Key Diseases		
Bacterial Blight (*Xanthomonas hortorum* pv. *pelargonii)*	Inspect geraniums more closely during warm weather. Look for isolated leaf wilting, wedge-shaped yellowing between the veins and small, round brown spots.	All geraniums are susceptible. Do not place ivy geranium hanging baskets over zonal geraniums. When infected, they do not show any distinct symptoms but can serve as a source of the disease.
Black Root Rot (*Thielaviopsis basicola*)	On incoming plugs of susceptible crops such as Calibrachoa, pansy, viola, creeping phlox, look for stunted plants with black, rotted roots that are not as water-soaked as with Pythium infections.	Infected plugs may be uneven in height. Wash roots off to look for characteristic Tootsie Roll-like overwintering spores.
Botrytis Blight (*Botrytis cinerea)*	Monitor closely during favorable conditions, i. e. cool temperatures, and free moisture. Look for fuzzy gray to brown fungal spores during humid conditions. Flowers may fade early and then mat together.	Plants may be attacked at any stage but new tender growth, freshly injured tissues and senescing or dead tissues are preferred. Look for tan to brown-stem cankers, and gray fungal growth on leaves or flowers. Monitor areas with poor air circulation, and where plants are closely spaced together.
Downy Mildews (*Peronospora, Plasmopara, Basidiophora,* etc.)	Monitor susceptible crops closely during cool, moist conditions.	Symptoms vary depending upon host plant. May be confused with nutritional disorders, Botrytis, or foliar nematode injury. Look on underside of leaves for fuzzy tan, gray or white sporulation during conditions of high humidity.
Powdery Mildews (*Erysiphe, Podosphaera sp. Oidium sp.)*	Look for white powdery growth especially on upper leaf surface of susceptible species.	Monitor closely in areas with poor air circulation, high humidity, or drafty places with more temperature fluctuations between day and night temperatures.
Pythium root and stem rots (*Pythium sp.)*	Examine roots for cortex that sloughs off leaving a central core and rat-tail appearance. Stem cankers are brown to black.	Monitor incoming plants and plugs. Closely inspect plants that may have been stressed by high salt levels, wounding, and transplant shock. Submit samples to a diagnostic laboratory to determine specific causal agent. Monitor electrical conductivity (EC) levels. High EC can encourage development of Pythium.

Rhizoctonia root rot, stem canker and web blight (*Rhizoctonia solani*)	Monitor seed flats of slow growing plants for post emergence damping off. Look for cobwebby growth (web blight) encouraged by high humidity.	Monitor seed flats especially near walkways. Web blight may occur when plants are tightly spaced during humid, warm conditions.
Viruses	Symptoms vary depending upon virus and host plant. Infected plants can also show no symptoms. Grower friendly immunostrips are available from Agdia.	Some symptoms of viral infections include stunting, chlorotic mottling, flower breaking, mosaic, ringspots, vein clearing, black or brown sections on leaves, and leaf distortion.

For photos of key insects and diseases, please see: **Scouting Guides: PDF files on the UConn Greenhouse IPM website:** https://ipm.cahnr.uconn.edu/greenhouse-publications/

Using Sticky Cards

Sticky cards are used to detect infestations of adult flying insects. Yellow colored cards attract **fungus gnats, shore flies, whiteflies, thrips, leafminers** and **winged aphids**. Blue colored traps are more attractive to thrips (and even shore flies), but it is more difficult to see the thrips against the blue background. Number and date each yellow sticky card and place in the greenhouse at the minimum rate of one card per 1,000 sq. ft. Space the cards equally throughout the entire range in a grid pattern. Place cards near all entryways and vents. Scout small greenhouses (<4,000 sq. ft.) as one unit. Divide larger greenhouses into 2,000 to 3,000 sq. ft. sections for ease of scouting.

Change the cards weekly, and place new cards in the same areas of the greenhouse to track trends. Identify and record pest numbers. Over time, population trends will emerge and provide direction for your pest management program.

Scouting and Monitoring

Perform scouting and monitoring weekly or, even twice weekly during the entire growing season. Perform scouting procedures as routinely as any other crop management task. Scouting must be intensive; the more plants monitored the better. Start at the major doorway, which is usually an entry point of pests. Pay special attention to plants near any openings in the greenhouse.

Use Pest Infested Indicator plants

Tag the first plant showing pest symptoms as an indicator plant to monitor effectiveness of treatments (biological control agents or chemical controls) or to track pest development. Mark and number the indicator plants with a colored flag or flagging tape so you can find them each week.

Making Pest Management Decisions

Each week, the manager, grower, and scout should review the scouting information. Pest numbers recorded from sticky card counts and foliar inspections, the use of

indicator plants, and identified reservoirs of pests and diseases will help to prioritize a pest management strategy. Once this information is analyzed, a decision must be made that will include the choice of pesticides or biological control agents; the rate, method, and site of application; and any other management techniques that may help solve the problem. Record every pest management action. Monitoring is an ongoing part of the management strategy.

Early detection will result in better pest management than letting a pest population get "out of control". If problems are detected early, better pesticide coverage may be achieved due to a smaller canopy and biological controls work more efficiently. Over time, growers will determine their individual threshold for a given pest. One grower may accept 10-15 thrips per sticky card per week, while another grower with a history of tospoviruses will not accept one thrips per card per week. At the end of each season, the grower and scout should examine their records to identify trends in pest populations and to review their management strategies to plan for the next season.

By Tina Smith, UMass Extension and Leanne Pundt, UConn Extension. 2010. Latest revision August 2024. Reviewed by T. Abbey Penn State Extension and E. Lamb, NYS IPM Program. Cornell University.

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