

### Offense Over Defense

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In the same way ecologists seek to understand the relationship between organisms and the environment, so do greenhouse growers seek to manipulate the outcome of those relationships. Plants won't thrive for many reasons and key among them are outbreaks of pests and diseases.

*Pictured: Scout for pest and disease problems by looking for symptoms on the undersides of leaf surfaces where they might otherwise be overlooked.*

Many features of the greenhouse environment work against us in this respect: high-quality food, nominal plant defenses, a relatively stable habitat, favorable microclimate and no natural enemies. These conditions lead to exponential population growth and pest eruptions. Growers must step in to impose limits before things get out of hand.

Herein is a review of the many tactics in a grower's tool box for preventing pest problems before they begin. Implementing all of these are improbable for any one facility, but every grower should be able to identify a few tactics that are feasible to execute or improve upon. Think of this overview as your eight "S" steps to success.

#### Screening

This entails retrofitting and engineering, starting with insect screening. Modern manufacturing technology has given us screening material so fine that even thrips can be excluded from the greenhouse.

Use this material to cover all ventilation openings, whether you have passive ventilation, or fan and pad systems. Screens this fine will reduce airflow, so it's important to consider how to expand the surface area to compensate for airflow reduction that could otherwise burn fan motors or reduce cooling.

Another exclusionary approach is the use of double door entries. These arrangements reduce the likelihood of wind-borne pests entering through walk-in doorways. It makes use of an air-lock entrance, which is typically a room added to the greenhouse exterior. Fans will pull in air through a screened vent, not the entryway. It may be convenient for these rooms to also house other sanitation techniques, such as foot baths and hand-washing stations.

#### Sourcing

Where were your plants before they arrived and how were they treated along the way? For instance, plugs and cuttings that come in with long-residual pesticides and pesticide resistance make a difficult start for any pest management program. Do what you can to strengthen the relationship with your supplier or with your customers so you can best communicate information about pest management.

Many pests can be shipped unknowingly in pots, media and on plant tissue. To prevent them from offloading in your dock, inspect the plugs, seedlings and cuttings immediately upon arrival.

Right after opening, carefully check plants for symptoms. If problems are identified, return or dispose of them without delay—certainly before they're unpacked and fully introduced into the greenhouse environment.

Remember, however, that zero tolerance may not be achievable, nor even favorable. Attaining 100% control may require heavy pesticide inputs; pesticide residues can cause failure of biocontrol programs. Prior exposure to multiple applications may compromise efficacy and may promote selection for pesticide resistance. When you do have to take action, try to first contact the source to find out what pesticides were recently used so you can select one with a different mode of action.

#### Sanitizing

Habitat management is one way to consider this. Eliminate weeds, old stock plants, unsaleable plants and pet plants, as these can all harbor pests and diseases that can reinvade otherwise healthy plants or sterile ranges. Install weed block fabric to prevent weeds and dispose of any plant debris in a timely manner. Keep dumpsters covered and remove stagnant pools of water.

Extend your efforts to outside the range as well. Manage the surrounding landscape by eliminating weeds and flowering plants from a 15-ft. buffer around the exterior. Disinfection also goes a long way—especially when it starts with cleaning and disinfecting tools. Use new or thoroughly disinfected pots, flats and trays. Regularly clean work surfaces. Employ foot baths at strategic areas or bottlenecks.



You should also consider a decontamination system to remove pathogens from irrigation water. If recirculated, water should be explicitly managed for Pythium, Phytophthora and other microbes. The concept of sanitizing also extends to maintaining and using clean growing media and to avoid taking cuttings from infested plants. If practical, maintain a quarantine area where you can set apart new or questionable material. Scout plants for a couple of weeks to identify any problems and then resolve them before they affect other plants.

Finally, the pest cycle can be broken, or at least interrupted, with the scheduling of “fallow” periods, or windows of time when the range is devoid of plant material.

## Scouting

Plant inspections are the most straight-forward approach. It means visiting a subset of plants to check for signs of pests and disease. This will require turning leaves over to identify issues with the undersides.

If honed in on insects, you can use plant tapping or beat sheeting to knock them onto a surface where they can more easily be seen and identified. Potato chunks are used to monitor for the presence of fungus gnat larvae; make them a regular part of your scouting program. Sticky cards are a valuable early detection tool, but remember, they only catch flying life stages. Reposition them as the crop grows so that they stay in the best zone for trapping. Well in advance of your first captures, make sure you know what a stuck thrips, whitefly, fungus gnat or winged aphid looks like (recall that book on the identification of road-killed animals?).

Sentinel plants should form part of your early detection system. Knowing which of your crop plants are prone to pests, monitor these regularly or over the windows of time when new pest and disease problems are expected to occur. You can also make use of pest-attractive, non-crop plants. These can be placed in strategic points among your regular plants. For instance, if you have a twospotted spider mite-susceptible crop, place some pots of green beans among them; spider mites will first appear there.

Finally, infested plants can be tagged and monitored. After an insecticide spray, for instance, go back to the infested plants to confirm that the application was effective.

## Staffing

Conduct periodic initiatives to strengthen awareness of personal hygiene and sanitation practices. Hand washing and disinfecting are relevant to disease transmission, as is the removal of soil and debris from shoes and boots. Foot baths should be set up at choke points, and they should be maintained and used without bypassing.

Have regular reviews with staff to promote adherence to general best plant care and greenhouse maintenance practices. Increase staff access to any relevant training. Consider offering incentives to your onsite staff for identifying and reporting problems.

## Spraying

When feasible, use cutting dips or immersion treatments. First and foremost, this is a way to clean up incoming plant material that might carry inocula or immigrants. Be aware, however, that phytotoxicity issues might be enhanced when the whole plant is submerged.

To prevent the development of pesticide resistance, rotate your classes of active ingredients when you have to make multiple interventions. Investigate any way possible to improve the coverage of spray applications, as this is vital for foliar pesticides that aren't systemic.

Contact insecticides have to land on or be quickly encountered by their target to be effective. Make sure that applications penetrate the foliage and reach the undersides of plant surfaces. At the same time, be aware that some pesticides come with instructions to spray to wet/glisten, not to drip. Fogging may be the best way to get full coverage for pesticides that are duly labeled because it combines small droplet size with canopy-penetrating currents.

## Socializing

Electronic newsletters and e-alerts are designed to keep you informed on current issues that will affect your management program. Many online resources are tailored to a specific geographic area, so find one that overlaps your locale, such as the “Greenhouse IPM Report” from the University of Maryland or the “Plant and Pest Advisory” from Rutgers University.

Others transcend geography and are more attuned to a specific industry, such as the e-GRO Alert (Electronic Grower Resources Online) for floriculturists. Industry, academia and associations are all sources of electronic information.

Mobile apps can also offer immediate access to grower information; this is relevant because early identification and diagnosis of problems is critical. The Purdue Plant Doctor App Suite—with Perennial Flower, Annual Flower and Tomato sections—is an example worth investigating.

## Strategizing

Carry this out with pest prevention specifically in mind. To the extent that you have flexibility in the selection of cultivars, favor the ones that are known to be less susceptible or even resistant. Plan to regularly test stock plants for disease and virus infection. Build in opportunities to disrupt the pest cycle by avoiding the continuous production of the same plant species in the same greenhouse range. Establish your problem plants in a common area where it's possible to limit through traffic. Finally, plan for down time so you can adequately address problems. **GT**