GROWERTALKS

Cover Story

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The Gear Guide

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Regardless of the name we use for it—survival kit, bug-out bag, ditch kit, etc.—we know what it is: a collection of essential gear to help you survive. But we don't need an apocalypse or zombie invasion to know we need certain tools and equipment. Sometimes a season in the greenhouse is enough to learn you need to be ready for anything.

Figure 1. The micronutrient toxicity in these geraniums could have been avoided if the pH and alkalinity of irrigation water was measured after acid injection was used, a different fertilizer selected to match water quality, and regular pour-through substrate tests were performed. Just a few simple tools make rootzone monitoring easy to do in-house.

The rootzone

The rootzone pH and electrical conductivity of the rootzone of containerized plants need to be managed to meet the needs of different species, such as low, general and high pH requirements and low, moderate and heavy feeding requirements. Several cultural factors influence rootzone pH and EC, including substrate, water and fertilizer inputs (Figure 1). Thankfully, the equipment used to measure pH and EC works for all these factors.

The most important tool for monitoring rootzone conditions is a combination pH and EC meter. These meters can be used to measure the pH and EC of clear irrigation water, water amended with water-soluble fertilizer and leachate from substrate tests. Reliable and rugged models can withstand years of abuse and you only need to replace the probe periodically to maintain precise measurements. For accuracy, always keep pH and EC calibration solutions so your instrument can be calibrated prior to each measuring session. And afterwards always remember storage solution to prolong the probe lifespan.

Alkalinity of water sources is another major factor influencing rootzone pH since you can essentially think of alkalinity like a "liquid lime"—higher alkalinity will push pH up and make it hard to drop, while low alkalinity keeps pH from rising. The alkalinity of water varies with sources throughout the year, as well. There are titration kits to determine alkalinity, but a much simpler and quicker approach is to use a colorimeter designed for quantifying alkalinity. By taking a small sample of water and a few drops of appropriate reagent, these colorimeters can provide precise and accurate measurements that allow you to make informed production decisions, including fertilizer selection and acidification.

Pests & diseases

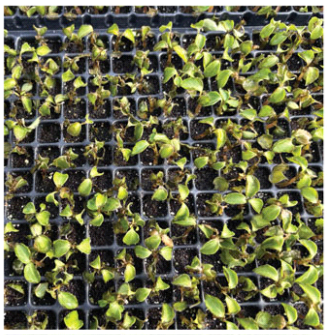
Identifying pests and diseases before they turn into infestations or outbreaks requires diligent and regular scouting. But observing pests and problems can be troublesome if you aren't equipped for the job.

While some insects may be first observed by inspecting plants closely, like aphids, most are harder to see. Sticky cards are an essential tool for capturing flying insects for identification and quantification. Sticky cards should be placed throughout the greenhouse, not just in select areas, with one card per 1,000 sq. ft. of growing space. They should be placed throughout crops—not just convenient places to grab and exchange them.

Yellow is the most widely used color of sticky card, as it's attractive to most insects, though blue cards may be used to increase the attraction of thrips for sensitive crops or lower thresholds. Sticky traps are a great tool for identifying flying insects, but there are some pests of concern that don't fly, like the larvae of fungus gnats. Placing potato wedges into the substrate in (i.e. 4 in. and larger) containers or potato discs on top of small containers (i.e. plug trays and packs) attract fungus gnat larvae for early detection.

Whether inspecting sticky cards and potato wedges or foliage and roots for symptoms and signs of pests and diseases, you'll want to use more than your naked eye for the most informative and accurate identifications and diagnoses. Thankfully, there are a range of tools varying in portability, magnification and cost. Hand lenses are the simplest tool to use for observations, though magnifying glasses offer comparable magnification, but a larger field of view. Whether recording pest counts, taking notes or handling plants, the hands-free headband magnifiers are great (but flip them up while you walk through the greenhouse!). For hard-to-see subjects, a simple dissecting or stereo microscope can be a great tool to keep in the headhouse.

Although signs of some pathogens such as Botrytis make them easy to identify, signs for others may not be so distinct. However, enzyme-linked immunosorbent assay (ELISA) test strips provide a quick and easy way to identify pathogens. These kits include a plastic bag with a re-agent and textured interior to aid macerating plant tissues and indicator strips for the pathogen. The most ubiquitous ELISA test strips are for diagnosing viruses, though there are test strips for some bacteria and a few fungi, as well (Figure 2). The results of most ELISA test strips provide a qualitative (yes or no) detection, though a select number of kits can also provide a quantitative measurement, too.



The growing environment

With the greenhouse being a controlled environment, many may mistake it for a crock pot—“just set it and forget it.” The environmental control greenhouses provide is the main value proposition they offer to producers, but that doesn’t mean it’s perfect.

Figure 2. Is this a biotic problem like a pathogen or is this an abiotic problem like spray damage? Using quick and simple enzyme-linked immunosorbent assay (ELISA) test strips can make in-house disease identification easy to confirm or rule out pathogens.

Figure 3. Basil is a cold-sensitive crop and can be damaged when temperatures get below 50F (10C). While the greenhouse temperature wasn’t set that low, the placement of these plants by an area where cold air was infiltrating the greenhouse and creating a micro-climate could have been caught with an infrared thermometer to check plant temperatures.

Infrared thermometers (Figure 3) are very useful for measuring plant temperatures and quantifying how they deviate from the air temperature. Although plant temperature tracks with air temperature for the most part, deviation certainly occurs and an infrared thermometer helps identify hot (or cool!) spots throughout the greenhouse. When skies are clear and no thermal curtains are drawn, or when plants are by walls, vents or exhaust fans, plant temperature can be lower than the target air temperature. Alternatively, when plants are dry or the sun or supplemental lighting intensity is high, plant temperature can be higher than the air temperature.

Another useful tool for the greenhouse is a quantum meter to measure light intensity. Although measuring the cumulative amount of photosynthetic light or daily light integral (DLI) a plant receives is a great way to quantify the light environment, measuring instantaneous light intensities can help identify bright or dark spots in the greenhouse.

For example, when short-day crops are being induced to flower, quantum meters can help measure any light pollution to ensure it’s below the 2 µmol·m–2·s–1 threshold for plants to sense “night.” On the other hand, quantum meters also help identify excessively bright areas that could potentially cause plant stress or damage foliage. Finally, quantum meters are very useful when supplemental lighting is used, as it can help measure the distribution of light from supplemental light sources and “map” the variation across the growing area.

Make sure the quantum meter you select is the right one for your application, as there can be variation in quantum sensors in meters with respect to the light they’re calibrated to measure (i.e. sun, light-emitting diodes or high-pressure sodium lamps).

Plant growth

Monitoring plant growth, or plant size, is another important tool to producing appropriately sized containerized crops. There’s a tendency to “eyeball” plant size and make judgments based on simple visual impressions. While we can look at crops and get a sense if they’re under- or oversized relative to their containers, the only way to know is to actually measure their size. Depending on the size of the plant, a ruler, yardstick or measuring tape are all effective means to the same end. To simplify measuring plant size, measuring sticks can be permanently placed in containers for the life of a crop, and height can be measured quickly and consistently. These measuring sticks can also be customized to highlight the target finished size in order to assist growth control decisions.

Using graphical tracking—the periodic measurement of plant size plotted against a target growth pattern—is commonly used with several potted flowering plants. Not all crops develop and grow the same way: garden mums have a straight or linear pattern, Easter lilies have two linear phases with different slopes, and poinsettias have a sigmoidal or S-shaped pattern.

An ounce of prevention

Investing in the relatively modest selection of tools and equipment won't just help you identify and conquer problems in the greenhouse—it should help you avoid them. A systematic regular approach to monitoring plant growth, the growing environment, pests and diseases, and the rootzone will produce high-quality crops … but, unfortunately, won't help you with the zombies.

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