Test the System, Grow Your Profits

Choosing the most appropriate methods for testing your greenhouse's nutrient management program is essential in running the most efficient operation possible

By Fred Hulme

For greenhouse and nursery businesses to remain profitable and sustainable in today's economic environment, production systems need to be as efficient as possible. To work toward this goal, growers must continuously identify and manage waste and other inefficiencies. Nutrient management is an important part of crop production. If you aren't monitoring key aspects of your nutrient management program, you may be wasting considerable financial resources that could be making a positive contribution to your bottom line. Analytical labs and good in-house testing are great ways both to measure your efficiencies and find areas for improvement.

Benchmarks for Success

When evaluating your nutrition management program, use the following benchmarks. A successful growing operation should:

- Deliver consistent quality results
- Strive to reduce crop shrinkage
- Select the correct products and rates to avoid problems and optimize production
- Make informed decisions and treat crops correctly when things go wrong
- Be aware of and minimize the environmental impact of any products or practices that it employs (e.g., nitrates, phosphates or other chemicals)

Even if you invest quality growing media, fertilizer, plugs, liners and cuttings — and start off perfectly at potting time — the interaction of these components with the irrigation water, environment, equipment or timing can often result in nutrient imbalances, deficiencies, pH and EC fluctuations, and plant stresses during production. Continually watching the crop is one of the most important ways to monitor crop status. There are many good visual guides available to help growers diagnose possible causes of a particular symptom in affected foliage. These can be helpful, but appearances are often deceiving, and a nutrient disorder isn't always apparent to the eye, especially during the incipient stages of development. Nutrient disorders can reduce overall crop quality, delay flowering, lead to crop losses and extend cropping times. A regular monitoring program can easily pay for itself by giving you the information you need to make adjustments before a problem develops.

Type of test	Use	Equipment needed	Site	Limitation
Root-zone pH and EC	Monitor crop status/ diagnose problem	Handheld pH/EC meters, measuring cup	In-house	Need to sample/ extract sample properly (pourthrough or 1:2); calibrate/read meter accurately; limited information
Irrigation/runoff solution EC	Monitor accuracy of acid injection, fertilizer recipe, injector accuracy, fertilizer program efficiency	Handheld pH/EC meters, measuring cup	In-house	Need to sample/ extract sample properly (pourthrough or 1:2); calibrate/read meter accurately; limited information
Comprehensive irrigation water analysis	Basis for selecting fertilizers/adding mineral acids	Sample bottle, mailer	Lab	Need to sample properly; cost; turnaround time
Spray-tank pH	Test solution pH to maximize spray component efficacy	Handheld pH/EC meters, measuring cup	In-house	Meter calibration/accuracy (there are easy-to-use indicator dyes on the marketplace)
Comprehensive growing media nutritional status	Monitor crop status/ diagnose problem	Sample plastic bag, mailer	Lab	Need to sample properly; cost; turnaround time
Comprehensive plant tissue nutritional status	Monitor crop status/ diagnose problem	Sample paper bag, mailer	Lab	Need to sample properly; cost; turnaround time

Table 1. *Where best to perform tests*

Planning a Testing Program

A well-thought-out testing program can serve as a quality-assurance program for nutrient delivery systems and a way to help growers remain profitable. You should plan a testing program before each season or cropping cycle. Remember that it doesn't make sense to measure any property unless you will use the data to make decisions; measure only what you need. For nutritional monitoring, growers typically analyze the status the growing system's key elements:

- Irrigation water sources, treated or untreated
- Fertilizer solutions
- Growing media or field soil, used or unused
- Plant tissue

To design an effective monitoring system, consider in-house technical resources — both people and equipment — and time, and the exact parameters you wish to measure. Depending on your operation's size and culture, testing might include both in-house and outside lab testing (see Table 1). Some values, such as pH and EC, can be quickly and economically generated on site. With routine in-house testing, growers can detect changes in the irrigation water, fertilizer concentration, growing media status and injector performance before they adversely affect a crop. If you can't invest in reliable testing meters and a qualified technician, won't keep equipment properly calibrated or will likely perform tests very infrequently, it might be best to outsource all testing to an external lab.

More complex testing (e.g., complete nutrient scanning) is most often best left to professional labs that have invested in expensive analytical

Sample Type	Frequency	How to sample	Comments
Irrigation Water	Once or twice yearly testing (spring/late summer)	Test every water source. Flush pipes, fill a clean 5-gallon bucket, submerse clean sample bottle, fill completely and cap underwater to avoid air bubbles.	Essential to select fertilizer program/treatment systems.
Growing Media	Sample regularly (weekly for in-house, monthly with an outside lab) when routinely monitoring crop or when problems are observed	Take a 1½- to 2-cup composite sample from middle layer of root ball. Take samples from affected and nonaffected plants when trying to troubleshoot.	Provides a snapshot of root zone nutrient status
Tissue	Take an ample sample (at least 1 ounce of fresh weigh)	General rule: Take most recently matured tissue from the same pots as media sample; if problem solving, test affected and nonaffected plants.	Results reflect what has already happened, tissue without soilless media results are almost worthless; very useful to diagnose plants in mineral soil

Table 2. *Proper Sampling*

equipment and maintain and operate it correctly. External testing may be more expensive per sample, and it may take longer to get the results, but you'll generally get more comprehensive, more accurate results than you can generate yourself. Today, most modern labs can provide results quickly via e-mail, dramatically decreasing previous turn-around times. Additionally, an outside lab service can often help growers interpret data and suggest appropriate actions based on the test results.

Testing Standards

Whatever in-house method you use to test root zones, it is critical that you choose and stick with a standard method (e.g., 1:2, SME, pourthrough), maintain a consistent, uniform sampling procedure and keep a database that you can easily access and use. Initially, it may be difficult to interpret in-house data, but if you keep notes corresponding to the crop condition and quality, and cross-reference with occasional outside lab testing, you will be able to define "normal" readings for your unique situation. There are published guidelines for various in-house testing methods, but it is best to adapt these acceptable test result ranges based on your own experience. Charting or graphing data can often make it easier to determine appropriate decision points. This will help you to know when to react very quickly to a changing crop root zone by leaching pots or switching to a basic fertilizer, for example.

Testing may be performed for a variety of reasons. It can be used to identify potential problems and gaps in the growing system, determine what types of fertilizers to use, check on a crop that is doing fine and identify the cause of any unusual symptoms that may result in poor production. Proper sampling is critical to get back the correct data (Table 2). While you may get accurate data back from the lab, the results from an incorrectly gathered sample can be quite misleading. "Normal" ranges on reports are tied to specific sample types; the more you deviate from collecting the correct sample type, the less useful the information will be. In some cases, testing incorrect sample types might lead you to take steps that will cause even more harm to your crop.

When selecting an outside lab, choose a reputable university or commercial lab and stick with it. Examine the following factors before you make your choice:

- Do they provide accurate nutritional analysis?
- How fast is their turnaround time? Generally, testing should be completed one to two days after the lab receives your sample.
- How much does each test cost?
- Are their testing and analysis methods appropriate and suitable to your operation?
- Are their reports easy to understand?
- Do they offer technical assistance in understanding or interpreting results for your situation?

Analyzing Data and Results

When you get analytical results back from a professional lab, the results should be organized to help you understand what is happening and decide a course of action. It is often very helpful to talk with a technical representative from the lab to decipher the data and determine appropriate next steps. Interpreting results is not always straightforward; don't consider data ranges as "written in stone" because results can be affected by many factors, including: specific crop needs, irrigation schedule, environment, fertilization regimen, crop timing and previous history.

One key thing to remember is that not all problems are caused by nutrient deficiencies or toxicities. You may have to consult a pathologist to identify the cause of a problem. That said, a system's approach to growing calls for reliable analytical data to help manage quality crops. Accurate and timely data can serve as a quality-assurance system to ensure that you are using your growing systems to their maximum potential. Careful scrutiny will help you select the proper fertilizer program, make sure your dosing equipment is functioning well, maintain optimal EC and pH in the root zone, reduce nutrient waste and leaching, and ultimately grow more consistent, higher-quality crops that increase your profitability. g

Fred Hulme is director of technical services for the Scotts Co. He can be reached at fred.hulme@scotts.com.