Best of the Best—How to Optimize Nursery BMP Techniques

JUANITA POPENOE1*, MATT LOLLAR2, AND LIZ FELTER3
1University of Florida, IFAS, Lake County Extension, 1951 Woodlea Rd., Tavares, FL 32778
2University of Florida, IFAS, Seminole County Extension, 250 W. County Home Rd., Sanford, FL 32773
3University of Florida, IFAS, Orange County Extension, 6021 S. Conway Rd., Orlando, FL 32812

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The Florida Department of Agriculture and Consumer Services requires growers to implement and maintain verified Best Management Practices (BMPs) for Nutrient Management, Irrigation Management, and Water Resource Protection. These practices are intended to improve water quality while maintaining agricultural production. An obstacle for many growers to fulfilling these requirements is an understanding of the tools and techniques required to implement the most important practices of measuring media electrical conductivity (EC) and pH, and measuring and adjusting irrigation uniformity. Management tools were evaluated including Electrical Conductivity (EC) Meters, pH meters, and irrigation uniformity. The EC Meters were evaluated using the pour-through method, the 2:1 extract method, and the substrate-paste method. Soil pH was measured with soil probes and solution probes from various manufacturers and results compared. Catch cup methods to assess irrigation uniformity and distribution were compared. Complying with state mandated programs is a daunting task for the high-energy nursery production industry. The results of this thorough investigation of which tools and implementations work best will allow more growers to feel confident in implementing BMPs.

Materials and Methods

During a program held to teach the most important aspects of the BMPs, 69% of the growers had already enrolled in the BMP program, but only 8% were practicing an important irrigation check and 42% monitoring were fertilizer levels. These practices were targeted as needing simplified procedures explained.

Fertilizer levels are normally monitored by measuring the soluble salts or electrical conductivity of the soil solution. This may be accomplished in several ways including a 2:1 extract, a substrate paste method (Ingram, et al. 2003), and a pour-through technique (Wright, 1986). These methods and two commonly available probes [Waterproof Tester HI98130 Combo pH/TDS/EC (Hanna Instruments, Inc., Woonsocket, RI 02895); and C66 EC Waterproof EC meter (Milwaukee Instruments, Inc., Rocky Mount, NC 27804)] were compared for ease of use.

Soil pH is important to the efficient use of fertilizer, but is commonly only monitored at the potting process and not during the growth of the nursery plant. Soil pH may be measured with the solutions collected in the EC monitoring or directly in the soil. Research has shown that the extraction method does not affect pH measurement (Huang et al. 2000). However, direct soil probes had variable readings and it was felt that an average of readings from three spots in each pot is required to get a good estimate of soil pH (J.J. Chen, personal communication, 21 May 2014).

Irrigation uniformity is measured by collecting irrigation water in a grid set out to cover a subsample of the irrigation block. The volume or depth of water (then converted to volume) in catch cans is used in sprinkler irrigation (Haman and Yeager, 2012). A calculation is then performed with the average volume of the lowest quartile of collected water divided by the average volume of all collected water to determine the percent Distribution Uniformity (DU). A target DU of 80% or higher indicates that the application rates are sufficiently uniform. Although this procedure seems simple, there are several tips to ensuring the process runs smoothly.
Results and Discussion

Of the three techniques used to extract a solution to measure EC, the pour through method was by far the easiest. The other two techniques required vacuum filtration equipment and/or much longer time to perform. Although the 2:1 extract method may be perceived to be more adaptable to larger containers, there is a risk of piercing fertilizer prills in handling the media thus causing an erroneous EC reading. In addition, the saturated paste method requires just enough water to saturate the media, which is somewhat subjective and may be inconsistent. The EC results are extraction-method dependent (Huang et al. 2000), so choosing a method and sticking to it is important for record keeping. If plug trays are used, a container under the whole tray can be used to collect the leachate for measurement (Huang et al. 2000).

The Hanna probe was much easier than the Milwaukee probe to calibrate, requiring only a press and hold button rather than a screw adjustment that was required of the Milwaukee probe. In addition the Hanna probe included a pH meter that increased the utility of the instrument. In considering a purchase of similar probes it is important to determine not only the differences in cost, but the ease of calibration.

Soil pH was easily measured alongside of testing EC by submerging the Hanna probe into the leachate water. The leachate water was then saved and pH was tested at the Extension Office using an Oakton pH 700 meter (Eutech Instruments, Singapore 139949). Results from the two meters were compared and differed by 0.1 (Hanna = 5.2 and Eutech = 5.3). Although the results were in close range from one another, it is still recommended that pH be verified with a stationary meter. It is still beneficial to own a Hanna probe for quick, onsite analysis.

Capturing irrigation water to determine DU can have several practical problems to overcome. If using light weight cups, the wind will often blow the cups around. Pebbles or marbles in the cups is a technique used by Mobile Irrigation Labs. If the irrigation is being measured in a block with larger plants that might impact the capture of water, ring stands can be improvised to hold the cans above the canopy or the cans can be tucked into the canopy, although this may increase the risk of accidental spillage. Using straight sided cans will allow a quick measurement of depth that can be converted to volume without the need to measure individual volumes. Alternatively if all catch containers are uniform, the volumes could be weighed in the catch cans rather than having to pour out and measure the volumes.

As indicated earlier, it has been discovered that most nursery/greenhouse operations in Central Florida have signed a NOI with the Florida Department of Agriculture and Consumer Services. However, survey results show a lack of consistency in methods used for measuring and calibrating the inputs for growing a profitable stock and protecting the environment. The goal of the program was not to enforce Florida statutes, but to demonstrate various methods of measuring critical growing parameters to optimize nursery BMP techniques.

Literature Cited