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Monitoring pH and EC of Growing Medium

Monitoring pH and EC of the growing medium helps prevent nutritional problems. In this Alert, we provide a review of the extraction methods to measure pH and EC.

This season many growers reported dramatic declines on the pH of the growing medium. Geraniums and New Guinea impatiens (and related hybrids) were among the most problematic crops (Fig 1). This group of crops are prone to iron/manganese toxicity when the pH is under 5.8. Many growers detected the problem when the symptoms were too advanced and this affected the final quality of the crop or finishing-time. We take this opportunity to review the methods of monitoring growing media in containers.

For more information about iron/manganese toxicity, check some of the earlier e-Gro Alerts of this season (Geraniums: Diagnosing Nutrient Disorders http://www.e-gro.org/pdf/2017_601.pdf).

In-house testing of the growing medium is the best way to detect changes before problems arise. Proactive monitoring is an essential component of crop management.

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Figure 1. Example of problems observed this growing season. Bounce impatiens with Mn toxicity (on the left) and zonal geraniums (on the right with iron/Mn toxicity caused by low pH in the growing medium.

Monitor the pH and EC of new batches of growing media.

Growing media companies have high production standards to achieve consistent quality of final products. However, in a few instances the quality of the growing media is different from what we have used in the past. Therefore, whether you are experimenting with a new mix or using the same mix you have used for many years, always monitor the pH and EC of new batches.

Peat-based mixes have a very low initial pH (3.5-4.0) and very little buffering capacity. Therefore, we expect that pH of peat-based substrates will be low and will decrease over time, if no limestone is added. The specific lime requirement to neutralize the peat's acidity depends on the source and the state of decomposition. This is why even though you may be using the same mix for many years, it is recommended to test new batches every time.

Measure the pH and EC of media straight out of the bag.

This measurement will indicate the initial pH and EC of the growing media. This information is used to identify noticeable anomalies, but it does not say anything about how the media will react over time.

Measure the pH of the growing media over time and estimate limestone requirement. We recommend that growers fill containers, combine the mix with various limestone rates, irrigate with clear water and zero leaching, and measure the pH over time (7, 10, 14, 21 days). This small trial will help determine the reaction of the growing media over time and the rate of limestone needed to maintain a stable pH.

Monitor the pH and EC of the medium in flats and containers.

Measure the pH and EC of the medium in containers in a weekly basis. This simple measurement is a good indicator of the growing media properties, fertilization practices, water quality changes, limestone reactivity, etc. Early detection of problems can save us time (money).

The key to a good monitoring program is to (1) select key crops (based on sensitivity to pH/EC or value of the crop); (2) be consistent on the method, personnel, sampling time and personnel; (3) follow the protocol strictly (e.g. always use distilled water and clean containers); (4) calibrate the meters weekly; and (5) keep records.

Extraction Methods

Several extraction methods are available to measure medium pH and EC in containers. The methods used in our industry are 1:2 method, saturated media extract (SME), pour-thru, and squeeze method. Growers should choose the method that fits best their operation based on experience of the personnel and references.

Two specific instances one method is preferred over others is when using sub-irrigation or when using controlled-release fertilizers (CRF).

Sub-irrigation. Saturated media extract (SME), 1:2 and squeeze methods are recommended over pour-thru when sub-irrigating. With sub-irrigating, salts accumulate on the top surface of the container, where salts are typically not available for plants. The pour-thru method may displace the salts to the bottom of the container and leach to the sample, providing inaccurate results.

CRF. Pour-thru is recommended over all the other methods when the growing media contains CRFs. The fertilizer prills in the samples can result in a higher EC measurement and can also change pH of the growing media. However, when the containers are too heavy to lift, pour-thru might not be an option. In the latter case, CRF prills should be carefully removed prior to conducting the 1:2 or SME test.

The SME method is preferred over the 1:2 method because it is not affected by moisture variability or exact volume of the sample.

Extraction Methods Step by Step

1:2 Method

1. Collect media from the bottom two-thirds of the container for pots or the whole cell for bedding flats. Collect a combined sample from multiple pots (5-10 pots or cells) from the same growing area.
2. Combine and homogenize the subsamples.
3. Measure 60 to 120 mL (2 to 4 oz) in a clean container. Make sure that the growing-media is slightly compressed to have an accurate volume measurement.
4. Add two-parts of distilled water for every part of growing-media. For example, add 4 oz. of distilled water to 2 oz. of growing media.
5. Wait 30 to 60 minutes.
6. Measure pH and EC directly on the slurry.

Saturated Media Extract (SME) Method

1. Collect media from the bottom two-thirds of the container for pots or the whole cell for bedding flats. Collect a combined sample from multiple pots (5-10 pots or cells) from the same growing area.
2. Combine and homogenize the subsamples.
3. Place around 300mL (8 oz.) in a clean container.
4. Stir the sample and slowly add distilled water until the samples has a paste texture. The paste texture will have a water glare on the surface without any free water.
5. Wait for 60 min.
6. Measure pH directly in the paste.
7. Filter sample and measure EC in the extract solution.

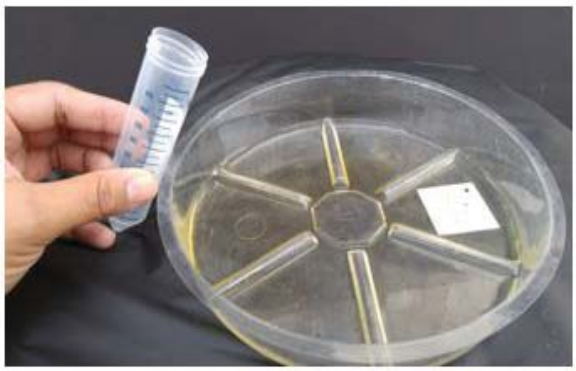
Squeeze Method

1. Irrigate the crop ensuring that the media is thoroughly wet.
2. Wait 30 to 60 minutes until the pots or flats have drained.
3. Collect plants, approximate 10 entire plugs or lower two-thirds of the container for larger pots.
4. Squeeze the solution from the media. As an option, filter the samples through paper towel or coffee filters to obtain a clean sample.
5. Measure the pH and EC in the extracted solution.

Pour-thru Method

The Pour-thru method is a non-destructive method to monitor pH and EC of the growing media. For more information go to: http://pourthruinfo.com/

1. Irrigate the crop ensuring that the media is thoroughly wet.
2. Wait 60 minutes until the pots or flats have drained.
3. Place a saucer under the container.
4. Add enough distilled water to obtain 50 mL (2 oz.) from the bottom of the pot.
5. Measure pH and EC directly on the leachate.



Interpretation of results

The interpretation of results will depend on the extraction method, crop (Fig 3) and growth stage. For optimum levels, please refer to the crop plans provided by the seed companies.

All extraction methods will provide the same pH measurements. In contract, EC results will differ by extraction method. Therefore, it is important to make sure that when we make interpretations we compare it to the same method or its equivalent. Most commercial horticulture analytical laboratories will use the SME method.

For example, below are equivalent results by extraction methods for actively growing plants and a general interpretation. Notice that an EC of 1 mS/cm obtained with the Pour-thru method is considered a very low level. Whereas, an EC greater or equal to 1.26 ms/cm obtained with the 1:2 is considered high and plant quality is expected to be affected.

Examples of EC (mS/cm) by extraction method

1:2	SME	Pour Thru	Interpretation
0.25	0.75	1.0	Very low
≥1.26	≥3.5	≥4.6	High

For more information on the importance of pH, specific crop requirements and management go to: http://www.e-gro.org/pdf/2017_610.pdf

Figure 3. Chrysanthemums presenting injury caused by high EC in the growing medium. DEspite the tolerance for high salt levels in the roots, chrysanthemums can also developbe affected by high salt content. Therefore, it is essential to monitor even those crops that we consider very tolerant to changes in growing medium.

Take Home Messages:

- Monitor the pH and EC of the growing medium anytime you get a new batch.
- Sample analysis cannot be better than the quality of the sample. Therefore, it is important to collect high-quality samples. Be consistent on how, when and who collects the samples and record changes in the growing media over time.
- Remember that changing any production factor (e.g. limestone source, fertilizer growing media, water source, crops, etc.) can affect plant nutrition in unexpected ways. Consequently, checking the pH over time is a must.

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