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1:2 Dilution Procedure: Determining Initial Substrate pH

Prior to transplant, growers can determine initial substrate pH by utilizing the 1:2 dilution method. This monitoring procedure determines: 1) the limestone reactivity thereby adjusting substrate pH; 2) if the substrate pH is too low or high; 3) if corrective procedures are required prior to transplant and; 4) establishes the baseline pH of the substrate.

Over the past two years, substrates with low pH have plagued many greenhouse growers. Low pH-induced iron (Fe) and/or manganese (Mn) toxicity symptoms often occurred weeks into bedding plant production season where action was required to adjust (increase) substrate pH to the optimal pH range of 5.8 to 6.2. In these instances, plants were 'saved' by utilizing one of three corrective procedures outlined in [e-GRO Alert 7.2](#). However, in other instances, corrective procedures could not 'save' plants because the plant aesthetics and quality were comprised, thus plants were discarded.

Utilizing in-house nutritional monitoring procedures, specifically, the 1:2 dilution method will assist growers in determining:

1. If the limestone has reacted to adjust substrate pH;
2. If the substrate pH is too low or high;
3. If correction procedures are required prior to transplant and;
4. To establish the baseline pH of the substrate.

Each of the aforementioned steps plays an important role in nutritional monitoring throughout the season.

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Figure 1. Example of a representative substrate sample. Photo by: W. Garrett Owen.



Figure 2. Moistening the substrate sample by adding distilled water. Photo by: W. Garrett Owen.

1:2 Dilution Method

Before conducting a 1:2 dilution procedure, one will need to gather the following tools to establish a kit:

1. Plastic 1 gallon zip-lock bag
2. 3-ounce cups
3. 24-ounce cups (3 cups)
4. Stirring utensil
5. pH/EC meter and calibration solution
6. Nutritional monitoring record sheets. Table 1, located at the end of this Alert, is an example of how to record pH/EC data and plot the nutritional status of the crop overtime.

Essentially, the 1:2 dilution procedure combines (by volume) 1 part pre-moistened substrate to 2 parts distilled water. The procedure can be used for both greenhouse and nursery substrates and those that are pre-formulated or formulated in-house. To determine the initial substrate pH, growers can use the 1:2 dilution method by following these steps:

1. Obtain a representative substrate sample of 1 gallon (Fig. 1) from either a loose-filled 2.8 cubic foot bag, bulk bag, or from a decompressed/fluffed bale or tower.
 - Note the lot number, substrate formulation and materials, and any amendments, e.g. nutrient starter charge, wetting agent, etc.
2. In a container, slightly moisten the substrate by adding distilled water (Fig. 2).
 - Note: The moisture content of the substrate should only be moist enough



Figure 3A. Checking the moisture content of the substrate by squeezing and holding the substrate in hand. Photo by: W. Garrett Owen.



Figure 3B. A ball of substrate should form when the moisture content is adequate. Photo by: W. Garrett Owen.



Figure 3C. Little to no water is extracted between fingers. Photo by: W. Garrett Owen.

that when you hold the substrate in your hand and a fist is made, little to no water drips between your fingers (Fig. 3A-C).

3. Place the substrate sample in a plastic bag and seal (Fig. 4).

4. Allow the sample to sit for 4 days. During this time, the water will react with the lime, allowing for a representative reading of the initial substrate pH.

5. After 4 days, mix the substrate by gently rotating the sealed plastic bag (Fig. 5).

6. Using 3-ounce cups (1 part by volume), extract three representative subsamples from the plastic bag (Fig. 6A). After each extraction, lightly tap the cup three times on a hard surface to allow settling (Fig. 6B). If the substrate settles below the rim of the cup, add more substrate to fill the cup to the rim (Fig. 6C). Repeat as needed until the cup is filled.

7. Place each subsample into containers numbered 1 to 3 and with a volume that can hold 24 ounces or 3 cups of wet volume (Fig. 7).

- Note: It is recommended to use a minimum of three subsamples to determine an average.

8. Add 6 ounces (2, 3-ounce cups) of distilled water (2 parts by volume) to the substrate (Fig. 8).

9. Using a stirring utensil, thoroughly mix the sample to form a solution which will often have a soupy consistency because of the excess water (Fig. 9).

10. Wait 30 minutes. During this time, one can calibrate the pH/EC meter (Fig. 10).

- Note: It is recommended to calibrate pH/EC meters before each use because measurements are only as accurate as the last calibration. Furthermore,



Figure 4. Moistened substrate sample placed in a zip-lock plastic bag and sealed. Photo by: W. Garrett Owen.



Figure 5. Gently rotating the sealed plastic bag to mix the substrate. Photo by: W. Garrett Owen.



Figure 6A. Three ounce cups are used to extract three representative subsamples from the moistened substrate sample. Photo by: W. Garrett Owen.



Figure 6B. After extraction, cups are lightly tapped three times on a hard surface to allow the substrate to settle. Photo by: W. Garrett Owen.



Figure 6C. Example of adding substrate to fill the cup to the rim. Photo by: W. Garrett Owen.



Figure 7. Placing each subsample into containers numbered 1 to 3. Photo by: W. Garrett Owen.



Figure 8. Add 6 ounces of distilled water (2 parts by volume) to the substrate subsample. Photo by: W. Garrett Owen.

proper pH/EC meter probe maintenance and storage should be practiced by following the manufactures instructions.

11. After 30 minutes, place the pH/EC meter probe into the solution (Fig. 11). Swirl the pH/EC probe until the pH and/or EC stabilizes by watching the meter's screen and record your measurement(s).

- Note: It is recommended to rinse the pH/EC probe off with distilled water between substrate subsamples and among different substrate samples.

By following these steps, one will be able to determine the initial pH of their substrate, mitigate the likelihood of low or high pH-induced nutritional disorders, and determine if correction procedures are required prior to transplant. Furthermore, it establishes the baseline pH of the substrate prior to production. When the 1:2 dilution and PourThru procedures are used together, it allows one to begin a nutritional monitoring program of the crop's nutritional status.



Figure 9. Using a stirring utensil, the solution is mixed. Photo by: W. Garrett Owen.



Figure 10. While waiting 30 minutes, calibrate the pH/EC meter. Photo by: W. Garrett Owen.



Figure 11. After 30 minutes, determine initial substrate pH by swirling the pH/EC meter probe into the solution. Photo by: W. Garrett Owen.

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Nutritional Monitoring

Date: _____ Substrate: _____ Lot No.: _____
 Crop: _____ Peat _____ Aged pine bark _____ Wood fiber _____
 Transplant week: _____ Perlite _____ Vermiculite _____ Limestone _____ Gypsum _____
 Finish week: _____ Wetting agent _____ Other: _____ Nutrient starter _____
 Initial pH: _____ Target pH: _____ Testing Procedure: PourThru SME 1:2 Dilution
 Fertility Program Fertilizer: _____ Rate: _____ ppm N Injector ratio: _____

Substrate pH	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
8.0																	
7.8																	
7.6																	
7.4																	
7.2																	
7.0																	
6.8																	
6.6																	
6.4																	
6.2																	
6.0																	
5.8																	
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4.8																	
4.6																	
4.4																	
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4.0																	

Initial

Production Week

e-GRO Alert

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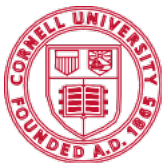
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