e-GRO Alert

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PourThru Method for Large Containerized Crops

The PourThru method is a great procedure to determine the nutritional status of containerized crops. This Alert outlines the steps needed to perform a PourThru on larger containers for mix combination planters, herbaceous perennials, and nursery or specialty crops.

Large containers are often used to produce annual bedding plants, e.g., combination planters (Fig. 1A), tropical foliage plants (Fig. 1B), herbaceous perennials (Fig. 1C), nursery stock (Fig. 1D), and depending on the production system, sometimes specialty crops such as food crops (Fig. 1E) and hemp (Fig. 1F). Containerized crops grown in soilless substrate overtime can become susceptible to nutritional disorders. These disorders are related to pH drift or fertility [soluble salts also referred to as electrical conductivity (EC)] because of reduced residual limestone effect to buffer substrate pH over long crop cycles and use of controlled-release fertilizers or fertigation, respectively. The PourThru method is a quick and easy technique that allows growers to evaluate the nutritional status by determining substrate pH and EC of crops in-house without disturbing the root-zone or sacrificing plant material for nutrient analysis.

The PourThru Kit

Prior to conducting a PourThru, growers will need to gather a few tools and supplies thereby establishing a nutritional monitoring tool kit, which very greenhouse or nursery should own. Nutritional monitoring tool kit items include:

1. pH and EC meter.
    - Combination pH/EC meter is preferred, but separate, single point meters for pH and EC can be used.

Figure 1. Large containers ranging in volume from 1 to 10+ gallons are often used to produce mixed combination planters (A), tropical foliage plants (B), herbaceous perennials (C), nursery stock (D), greenhouse food crops (E), and hemp (F). Photos by: W. Garrett Owen.

2. pH calibration standard(s).
    - Most new pH/EC meters provide sample-sized standards packets of 4.0 and 7.0, and sometimes 10.0. Consider purchasing larger bottles of standards and if available, select solutions with different colors.
3. EC calibration standard.
    - Most, if not all pH/EC models, require an EC calibration standard of 1.413 mS/cm (or 1413 µS), but check manufacture recommendations. This solution is often clear.
4. Storage solution.
    - This solution is only used to keep the electrode from drying out during storage and placed in the protective electrode cap.
5. Distilled water.
6. Plastic saucers.
    - Used for collecting the sample leachate. It is recommended to have 5 to 10 clear plastic saucers so that growers can sample multiple plants per crop, species, or plants exhibiting nutritional disorder symptomology. Consider purchasing different size saucers that will fit under varying container sizes used by the nursery or greenhouse.
7. Sample cups.
    - It is recommended to have 5 to 16 oz. plastic cups. Leachate sample volumes will typically increase with container size, so larger sampling cups may be required.
8. Paper towels.
    - Used to wipe the electrode clean of substrate particles and distilled water prior to capping and storing the meter.
9. Wash bottle.
    - It is useful for rinsing the electrode between samples, but not a necessity.

PourThru Method for Large Container-Grown Crops

The general procedure to perform a PourThru on large container-grown crops is outlined below:

1. Irrigate 3 to 5 representative plants or the entire crop to container capacity using either clear or fertilizer water if you typically fertigate (Fig. 2). To know if you irrigated enough, check or watch to see if water is dripping from container drainage holes. Leaching between 10% to 20% is expected.

2. Wait 30 minutes to 2 hours for equilibration of nutrients in container solution before testing.
3. Calibrate the pH and EC meter before testing by following instructions provided by the manufacture (Fig. 3). Leachate pH and EC readings are only as accurate as the last calibration. It is recommended to only use fresh, standard solutions and never pour used solutions back into the original bottle.
4. Place a plastic collection saucer under each container to be sampled (Fig. 4).
5. Pour distilled water over the substrate surface, circling the plant (Fig. 5). Avoid applying the water to one location on the substrate surface. Table 1 provides values of the volume of distilled water to apply to varying container sizes. Apply enough water to collect 1.7 to 3.0 fl. oz (50 to 90 ml) of leachate each time you sample. However, the amount of water needed to apply will vary with the container size, crop, and environmental conditions.
6. Collect leachate from each saucer for pH and EC evaluation (Fig. 6). Note, keep leachate samples separated and samples >3.0 oz (90 ml) may cause adilution effect and provide lower EC readings. Table 1 provides the volume of leachate collected for the volume of distilled water applied to varying container sizes.
7. Test leachate samples and record the pH and EC values for the specific crop and cultivar (Figs. 7A–B). Testing should be performed as soon as possible. Leachate pH can change within 2 hours of sampling and minimizing leachate evaporation will result in little change for EC values.

Figure 2. Irrigate 3 to 5 representative plants or the entire crop to container capacity. Photo by: W. Garrett Owen.

Figure 3. While waiting 30 minutes to 2 hours, calibrate the pH/EC meter. Photo by: W. Garrett Owen.

Figure 4. Place a plastic collection saucer under each container to be sampled. Photo by: W. Garrett Owen.

8. Interpret results of the leachate samples (Fig 7C). Table 2 provides optimal pH and EC levels of containerized perennial, nursery, and specialty crops. For other crops not listed, use the [e-GRO Nutritional Monitoring Advisor] and search by scientific name.

9. Take correction action. Correction procedures for modifying substrate pH and EC are outlined [in e-GRO Alert 7.2].

By following these steps, growers will be able to determine the substrate pH and EC of their large containerized crop(s); mitigate nutritional disorders; and determine if correction procedures are required.

Figure 5. Pour distilled water over the substrate surface, circling the plant. Photo by: W. Garrett Owen.

Figure 6. Leachate will collect in the saucer (A). Collect leachate from each saucer for pH and EC evaluation (B). Photos by: W. Garrett Owen.

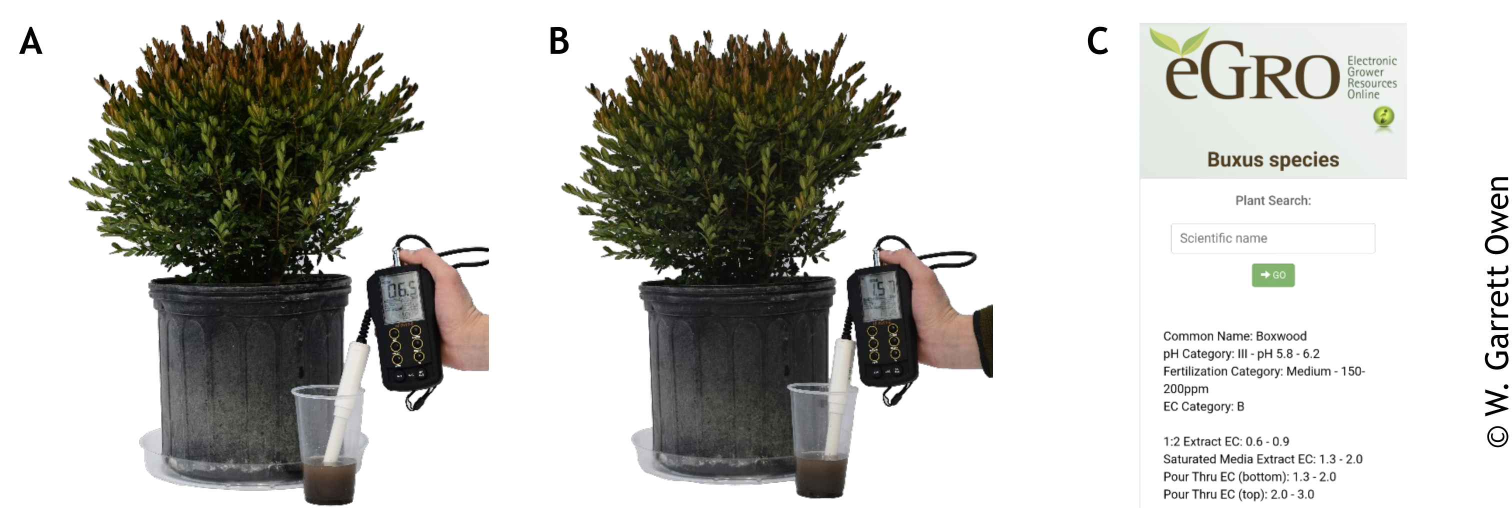

Figure 7. Test leachate samples and record the pH (A) and electrical conductivity (EC; B) values for each plant. Interpret results of the leachate samples (C)). Photos by: W. Garrett Owen.

To learn more about nutritional monitoring procedures, refer to e-GRO's fertdirtandsquirt.com. To learn more about determining initial substrate pH and sampling, refer to e-GRO Alerts 8-01: 1:2 Dilution Procedure: Determining Initial Substrate pH and 10-01: Sampling Substrates for Routine or Diagnostic Lab Analysis, respectively. To learn about leaf tissue sampling, refer to e-GRO Alerts 9-06: Target Leaf Tissue Sampling for Precise Nutrient Diagnosis. To learn about sampling irrigation water for analysis, refer to e-GRO Alerts 10-09: Sampling Irrigation Water for Routine Lab Analysis.

For a free downloadable corrective procedures poster (11" × 17"), refer to Corrective procedures for high and low substrate pH and electrical conductivity.

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Table 1. General guidelines for the volume of distilled water applied and estimated leachate collected for various nursery container sizes using the PourThru procedure.

Container size	**Distilled water applied**		**Estimated leachate collected**	
	ml	**fl. oz**	**ml**	**fl. oz**
1 qt.	70	2.4	50	1.7
1 gal.	75	2.5	50	1.7
3 gal.	80	2.9	50	1.7
5 gal.	120	4.1	50	1.7
10 gal.	150	5.1	90	3.0

Table 2. Optimal pH and electrical conductivity (EC) ranges determined by the PourThru method of containerized perennial, nursery, and specialty crops grown in soilless substrates.

Crop	pH	EC (mS/cm)
Herbaceous Perennials		
Hyssop (*Agastache foeniculum*)	6.0 – 6.5	1.3 – 2.0
Tickseed (*Coreopsis* sp.)	5.8 – 6.2	1.3 – 2.0
Blanket flower (*Gaillardia aristate*)	5.8 – 6.2	1.3 – 2.0
Coral bells (*Heuchera* sp.)	5.8 – 6.2	1.3 – 2.0
Hosta (*Hosta* sp.)	5.8 – 6.5	1.3 – 3.0
Shasta daisy (*Leucanthemum* sp.)	5.8 – 6.5	1.3 – 3.0
Lavender (*Lavandula* sp.)	5.8 – 6.2	1.3 – 2.0
Miscanthus (*Miscanthus* sp.)	5.8 – 6.5	2.0 – 3.0
Russian sage (*Perovskia atriplicifolia*)	5.5 – 6.2	2.0 – 3.0
Perennial sage (*Salvia nemerosa*)	5.5 – 6.2	2.0 – 3.0
Nursery Stock		
Barberry (*Berberis* sp.)	5.8 – 6.2	2.0 – 3.0
Boxwood (*Buxus* sp.)	5.8 – 6.2	2.0 – 3.0
Butterfly bush (*Buddleja davidii*)	5.8 – 6.2	2.0 – 3.0
Euonymus (*Euonymus* sp.)	5.8 – 6.2	2.0 – 3.0
Forsythia (*Forsythia* sp.)	5.8 – 6.2	2.0 – 3.0
Gardenia (*Gardenia* sp.)	5.5 - 5.8	1.3 - 2.0
Holly (*Ilex* sp.)	5.8 – 6.2	2.0 – 4.3
Juniper (*Juniperus* sp.)	5.8 – 6.2	1.3 - 2.0
Rose (*Rosa* sp.)	5.8 – 6.2	2.0 - 3.0
Viburnum (*Viburnum* sp.)	5.8 – 6.2	2.0 – 3.0
Specialty Crop		
Hemp (*Cannabis satvia*)	5.8 – 6.2	1.0 – 2.5 (Development stage dependent)

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