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GREENHOUSE AND INDOOR PRODUCTION OF HORTICULTURAL CROPS

# Pour-through Technique of Measuring Electrical Conductivity of the Substrate

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Electrical conductivity (EC) is a term used in chemistry but has a practical value for greenhouse growers. It measures how well a fluid accommodates transport of ions. A fertilizer solution contains many fertilizer ions. The more fertilizer ions in a solution, the higher is EC. Thus, EC measures concentration of fertilizer in a solution. Electrical conductivity can be used to measure fertilizer concentration in the supplied solution and inside the substrate. It is more effective to manage plant nutrition based on substrate EC than on fertilizer solution EC, because measuring the substrate gives you a reading of the amount of nutrients in the root zone.

There are in-house and laboratory-based methods of measuring substrate EC. One popular in-house method is called the pour-through technique. This technique is rapid, inexpensive, and measures EC of solution in the substrate pores (that is, it measures pore-water conductivity). Many growers are unaware of how to accurately perform the pour-through. This publication is a guide to help you perform this test accurately.

The technique for the pour-through test involves collecting solution from the substrate pores in a saucer and using an EC meter to measure the EC of the collected solution (called leachate).

Here are six steps to take to get accurate results (also see Figure 1):

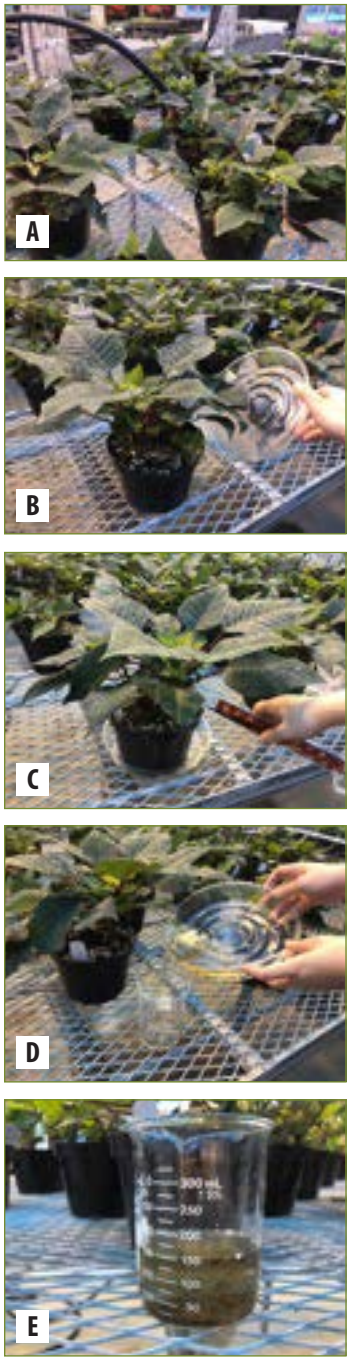



**Figure 1.** These photos show the steps to follow for using the pour-through method. **A.** Fertilize thoroughly an hour before testing. **B.** Place saucers below sample. **C.** Add a small volume of fertilizer solution on the top. **D.** Collect substrate leachate in a saucer. **E.** Combine leachate from several pots. **F.** Measure EC with a meter.

## Step 1: Fertigate Thoroughly

Uniformly fertigate your plants to container capacity (or until water starts to leach out of containers). Use the regular fertilizer solution at least an hour before you sample. During this one hour, the fertilizer solution in the pores will come in equilibrium with plant/root uptake.

## Step 2: Select Samples

Place a saucer below the containers you are sampling to collect the leachate. Remember to:

1. Sample plant species that have different fertilizer needs separately
2. Sample at least five pots or cell packs per 1,000 plants and mark them
3. Randomly select plants from the interior of the bench and account for different growth stages during sampling (establishment, active growth, and bloom)

## Step 3: Wait and Reapply Fertilizer Solution

An hour after fertigating the plants, reapply a small volume of fertilizer solution uniformly to the top using the volumes shown in Table 1 for different container sizes. Use the same fertilizer solution that you normally use to grow plants (not pure water). You do not want to dilute the nutrient concentration in the containers by adding pure water while you are sampling.

When you apply a small volume of fertilizer solution to the substrate that is at container capacity (that is, substrate is holding maximum amount of fertilizer solution), the newly added solution will push the existing solution that is in the pores down. This way, you collect the solution that is in the pores in the saucers while the applied solution refills the pores. By doing this, we are sampling the solution in substrate pores that was in equilibrium with roots. If you apply too much solution at the top second time, the applied solution also starts to leach out of the containers and gets collected in the saucers resulting in erroneous data (Figure 2).

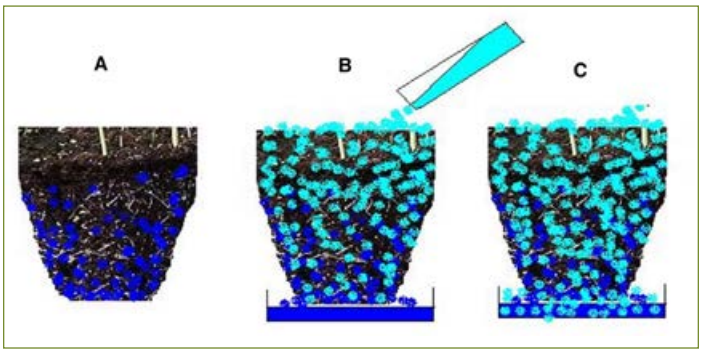


**Figure 2. A.** This illustration shows that the substrate contains solution in its pores that is in equilibrium with roots. **B.** This illustration shows the correct pour-through procedure. Note that the volume of fertilizer solution applied at the top during Step 3 is now in the substrate while the solution in pores from Step 1 has leached into the saucer. **C.** This illustration shows the incorrect procedure. If you apply excess fertilizer solution to the substrate in Step 3, it will leach out of the containers along with the solution that was already in the pores from Step 1.

## Step 4: Collect Leachate

After the second application, collect the leachate that drains into the saucers from the pores.

## Step 5: Combine Leachate

Combine the leachate you collected from your different samples into a beaker. Make sure to keep leachate from different species and growth stages separate.

## Step 6: Record EC

Use an EC meter to measure the collected leachate. Use the values in Table 2 to identify if the fertilizer status is in the optimal range, or compare the EC with other laboratory-based methods like 1:2 dilution or Saturated Media Extract methods.

**Table 1.** Approximate volume of fertilizer solution to be applied in Step 3 to the top of the substrate at container capacity for different container sizes.

| Pot Size | ml | oz. |
|---|---|---|
| 4 inches | 75 | 2.5 |
| 5 inches | 75 | 2.5 |
| 6 inches | 75 | 2.5 |
| 6.5 inches | 100 | 3.5 |
| 1 quart | 75 | 2.5 |
| 4 quarts | 150 | 5.0 |
| 12 quarts | 350 | 12.0 |

**Table 2.** Comparison of pour-through technique with other laboratory-based methods of measuring substrate EC.

| Substrate-based EC Measurement Techniques | | | |
|---|---|---|---|
| **1:2** | **SME** | **Pour-through** | **Indication** |
| 0-0.3 | 0-0.8 | 0-1.0 | Very Low |
| 0.4-0.8 | 0.9-2.0 | 1.1-2.6 | Low |
| 0.9-1.3 | 2.1-3.5 | 2.7-4.6 | Normal |
| 1.4-1.8 | 3.6-5.0 | 4.7-6.5 | High |
| 1.9-2.3 | 5.1-6.0 | 6.6-7.8 | Very High |
| > 2.3 | > 6.0 | >7.8 | Extreme |

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