Understanding the measuring of Electro-Conductivity (EC)

Product

Bluelab Pulse Meter

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1 Types of Electro-Conductivity (EC) measurements

1.1 EC Bulk (ECB)

Bulk Electro-conductivity (EC) includes substrate, solution, and air.

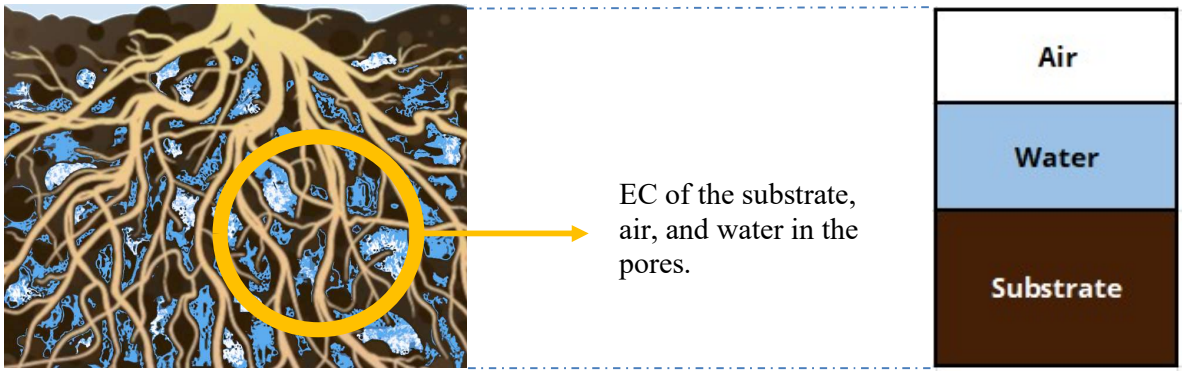


Figure 1. Bulk EC, measures volume conductivity

1.2 EC Pore (ECP)

The Electro-conductivity (EC) of water in the pores of the substrate.

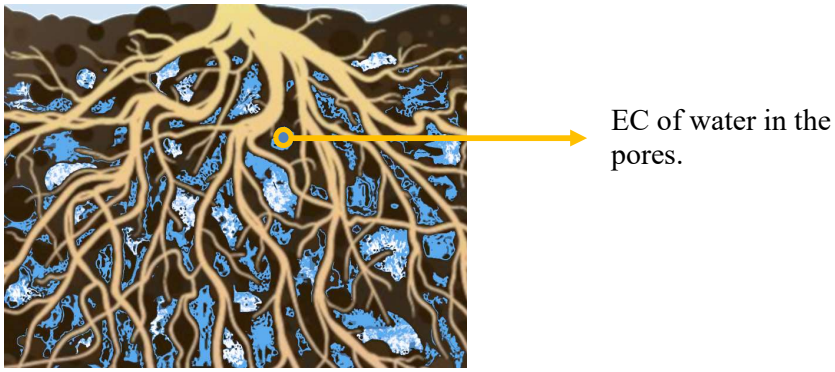


Figure 2. Measures conductivity in pores

2 What Pulse measures

Pulse measures the Electro-conductivity in the pores of the substrate indirectly, as it is a better indicator of how many nutrients are available in the root zone.
The EC of water in the pores cannot be measured directly so it must be calculated.
The EC pore is affected when the soil moisture is low.

2.1 Measurements with Mixed Media Models

When Pulse measures, using any of the mixed or calibrated media models, the EC Pore is calculated based on the moisture measurement.
The electrical conductivity of the pores is the most appropriate measure for growers because they are the nutrients that are available to plants in the root zone.

2.2 Measurements with "Solution" model

When Pulse measures using the "Solution" model, the EC bulk is calculated.

The solution is homogeneous, and the conductivity is constant throughout the liquid. Therefore, an EC bulk measurement is relevant and representative.

3 What other instruments measure

Many of the instruments measure the EC Bulk of the substrate, it is possible to identify these devices by the price since the value increases significantly in case of measuring the conductivity in the pores.
Some of them require frequent calibration to compensate for the deformations produced in its sensors. Pulse does not require to be recalibrated due to the materials used.

4 Comparing bulk EC versus EC of water in pores

The EC Pore will always be greater than the EC bulk.

- If the EC of the water retained in the pores could be measured directly with a sensor, the conductive path would be uninhibited being only water.
- When bulk EC is measured, substrate particles and air pockets increase the conductive path by reducing the measurement value.
- As a result, the bulk CD is always less than the EC of water in the pores.

5 Factors influencing measurements

5.1 The influence of humidity

Both ECs are influenced by humidity.

- Both ECs increase as the moisture of the substrate increases because more ions are dissolved and become available in the pores.
- As substrates dries out, the EC bulk and EC pore diverge significantly.
- Measure at the same moisture level of the substrate (at the same time after irrigation) to compare EC levels.

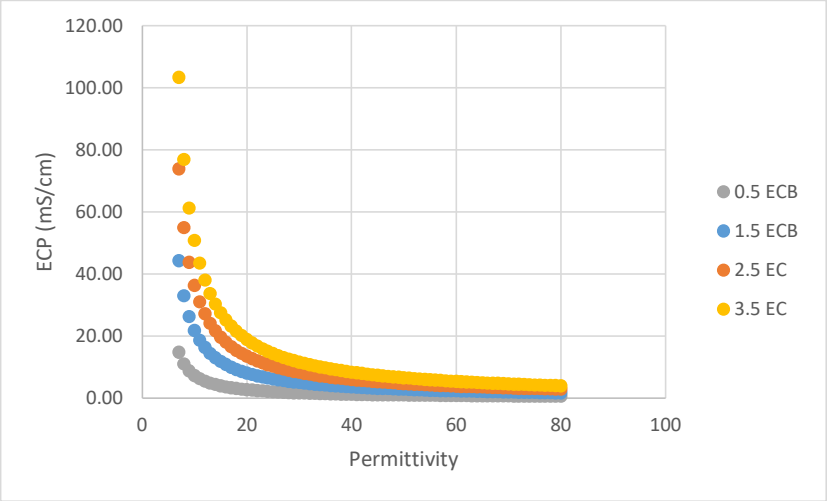


Figure 3. ECP vs Permittivity Relationship

5.2 The influence of temperature

The EC Bulk and EC pores are influenced by temperature.

- As the temperature increases, the EC bulk and the EC pore will decrease in mixed media and on the calibrated media models.
- Pulse compensates the EC for the temperature in solution. At two different temperatures the EC will be the same.

This is the same method used to compensate for EC with our solution measuring devices.

6 Best practices with the Pulse meter

6.1 Understanding the root zone

Due to factors including the composition, texture, and compaction of the substrate the EC can vary. Measure in multiple locations to understand the variability around the root zone, then select a representative location (reference location).

The temperature of the root zone will change during the growing season; this can influence the EC measurements.

Consider the measurements as relative, use the data to guide the analysis of trends in soil measurements.

6.2 Pulse Calibration

Pulse can be calibrated to the field capacity of a specific medium.

- Calibration sets the field capacity to 100%.
- The measurement of field moisture content is then a percentage of the field capacity.
- This is useful for guidance when measuring EC in relation to field capacity.
- When comparing measurements, compare to the same humidity level.
- EC cannot be calibrated in Pulse (Factory Calibrated).

6.3 Using calibration

The field capacity of a root zone changes with plant growth.

- As root growth increases, media compaction can increase by reducing pore spaces. This can affect field capacity.
- Calibrate through the growth stages of the plant, for example, new plants and mature plants.
- Caliber in healthy plants for good environmental conditions.

6.4 Monitoring of the EC of water in the pores.

Keep measurement conditions consistent: Humidity, location, and depth.

1. Be consistent: Measure at the same time after irrigation, for example, always measure one hour after irrigation.
    a) The most accurate measurement for the EC pore is when the substrate is in field capacity. Usually, one hour after irrigating.
    b) Pulse can be calibrated to field capacity to aid in this.
2. Measure in the same location in the root zone.
3. Keep the depth of the probe constant: Use the depth limiter (probe cover).



Figure 4. The probe cover is also a depth limiter.