UNDERSTANDING THE IMPACT OF EC ON PLANT NUTRITION

Here is a common scenario. *"My plants are stunted, the leaves are necrotic, and the roots tips look burned. I am fertilizing properly, water as needed, and I provide the right environmental conditions for the crop to grow. What is the problem?"* Perhaps the soluble salt levels have become too high in the growing medium.

Let's start with some definitions. Electrical Conductivity (EC) is a term used to measure the electrical current that passes thru a solution and is expressed in dS/m or µmho/cm. Pure water does not conduct electricity but water with salts does. When the EC of a solution is high, the sum of the salts in the solution is high. The EC can be measured with an EC-meter, an instrument that estimates the electrical conductance of a solution and not the concentration of individual ions, like Nitrogen. There can be some confusion between EC and Total Dissolved Solids (TDS). A TDS-meter estimates the total dissolved solids in a solution and is expressed as mg/L (ppm). EC can be converted to TDS by multiplying by 670 (which is an average of 640-700 mg/L used by most laboratories).

Salts originate from fertilizers, irrigation water, injected acids and/or pesticides. Fertilizers are composed of mineral salts with each formulation having different chemical composition and concentration of elements. For this reason, the EC of the nutrient solution will be different for different water-soluble fertilizers. As concentration of the fertilizer increases, so does the EC of the nutrient solution. Most fertilizer manufacturers provide a table that correlates nitrogen application rate with the EC of the fertilizer solution. For example, the application of 20-20-20 and 25-5-15 at 200 ppm N, using a 1:200 injection ratio, will give an EC of 0.84 dS/m and 1.14 dS/m, respectfully. For 100 ppm N solution, this EC will be half, or 0.42 and 0.57 dS/m, respectively. Remember that irrigation water contributes salts, and the final EC of these nutrient solutions will be higher, therefore subtract the water EC from total EC to obtain fertilizer EC.

It is important to clarify that most fertilizers and salts disassociate into either anions (-) or cations (+) when dissolved in water which allows electrical current to flow in the solution. Fertilizers are commonly injected into the irrigation system and will remain in the growing medium until the plant requires them. Fertilizers and salts can accumulate over time unless the growing medium is leached periodically. High EC in the growing media results in greater negative osmotic potential; therefore, roots must work harder to extract water and nutrients from the substrate. Therefore, it is recommended to irrigate plants with water having an EC <2 dS/m. This number depends on the plant type (heavy feeders or low feeders), stage of the plant and environmental conditions.

Water quality for irrigation is extremely important even if Reverse Osmosis (RO) water is used. It is highly recommended to send water samples to a laboratory in the beginning of the season to know the concentration of each element. It is essential to select the fertilizer based on the alkalinity of the water since this has a direct impact on the pH of the substrate. Moreover, it is important to know the EC of the water and low EC is preferable because there is room to choose a wide range of fertilizers. Choosing a fertilizer is easy when RO water is used as the EC of the water is close to zero but be advised that the alkalinity will also be low affecting the buffering capacity of the solution. Generally, water for irrigation contains elements are needed by plants, especially Ca, Mg and SO_4, however fertilizers must be used to reach the desired concentration. Conversely, there are waste elements that can be toxic for plants (i.e. Na>50 mg/L) or elements in excess (i. e. B>0.5 mg/L and Cl>70 mg/L) which may lead to plant problems. It is best to have the right ratios between elements (in solution and substrate) to avoid ion competition or antagonism.

Finally, the EC of the substrate can be estimated by the Pour Thru, the Saturated Media Extract or the 1:2 method. High EC in the substrate is a result of salt build up (especially Na, Cl, Ca, Mg, SO_4), so leaching is required. If the EC is low, the concentration of nutrients is also low, and plants may experience nutrient deficiencies. The key is to increase the concentration of the nutrient solution or the fertilizer application frequency. Frequently test pH and EC of the nutrient solution and substrate to avoid or identify problems early. Always use a laboratory to confirm any problem(s) and ask for support from the Premier Tech's Grower Services team.

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