The effect of water and oxygen on rooting
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Plants need oxygen in the substrate to grow roots. We are investigating ways you can increase root health, looking at technology options including the substrate porosity, compaction, irrigation practices, and water oxygenating systems.

Research questions:
- During propagation with overhead mist irrigation, how much oxygen is available in a cell? Are growers over-irrigating and saturating substrate? Does most available oxygen come from the water (dissolved oxygen) or the air (substrate pores)? How should you best deliver oxygen to the unrooted cutting and promote root growth during propagation?

Our approach:
- We are using an optical oxygen probe (NeoFox, Ocean Optics) to measure dissolved oxygen and oxygen gas in container substrate. Developing a method for measuring oxygen in liner trays.
- We can also estimate oxygen based on tray weight using a logging scale (where propagation trays are weighed over time (7 to 14 days) in commercial greenhouses to evaluate current watering practices.

Some key findings so far:
1. Oxygen is present in the air at 271 mg/L at 25°C. Oxygen can dissolve in water to form dissolved oxygen at 8.24 mg/L at 25°C. More oxygen can be held in water at low temperatures. Air holds more oxygen than water, and diffusion coefficient is 10,800 times greater in air than in water at 20°C.
2. Saturation of the substrate during irrigation (filling all pores with water, liner on left below) reduces oxygen level compared with allowing the substrate to drain to container capacity (liner on right below).
3. Passing water through a fogger nozzle increased oxygen solubility to 126% relative to tap water at 100%.
4. Oxygen injected into water with an oxygenating system increased oxygen solubility to 340% relative to tap water.

How can you use this information?
- Our initial results emphasize that water and substrate management are the keys to providing oxygen to roots: Do not overwater, do not over-compact, and ensure there is adequate air porosity without extremely fine particles.
- We will be testing the effects of substrate porosity, compaction, and “super saturation” of water with oxygenating systems on oxygen level and rooting. This will help you make management and investment decisions.

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