The Effect of Water and Oxygen on Rooting
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• Oxygen in the root zone is essential for root growth and nutrient uptake.
• High humidity and frequent irrigation during propagation of cuttings increase risk of low oxygen supply to roots.
• Oxygen injecting technology for irrigation water is being promoted by companies to increase dissolved oxygen (DO) levels in irrigation water. However, there are limited data on the use of oxygenated water for container-grown plants.

Objective
• To measure the effect of oxygenated (30 mg/L) compared to ambient “tap” (7 mg/L) water for (1) rooting of plant cuttings and (2) finished plants in 4-in pots.

Approach
We have run a series of experiments measuring DO in irrigation water and substrate, and quantified effects of oxygenated water on plant growth.

1. **Plant propagation trial** (March to April 2016) with calibrachoa ‘Aloha Kona Dark Red’ and lobelia ‘Belia Aqua’. Plants were irrigated with either oxygenated (30 mg/L) or ambient (7 mg/L) tap water through a mist nozzle. Unrooted cuttings were transplanted in 102-count trays filled with a 60 peat/40 perlite (v/v) substrate. Irrigation frequency was high for the first three days and gradually decreased. The average day temperature was 22.5°C and average relative humidity was 72%.

Key findings:
• **DO rapidly came to equilibrium with the atmosphere** (around 8 mg/L) when passed through a mist nozzle, regardless of initial DO level from the oxygenation or ambient treatments. For more details on DO measurements, see our video in FloricultureAlliance.org under “Current Projects”.
• Oxygenation of irrigation water did not affect root growth when compared with ambient water.
• No differences were observed in root growth (root length, or plant dry mass) when compared by species for ambient or oxygenated water on day 7 or 14 for lobelia and calibrachoa cuttings.
2. **Finished plant trial** (April to May 2016) with calibrachoa, lobelia, and geranium ‘Patriot Red’
   - Lobelia, calibrachoa, and geranium plants were top watered or subirrigated with 17-4-17 at 150 ppm using either oxygenated or ambient tap water.
   - Rooted cuttings were transplanted in 4-in. diameter pots filled with a peat:perlite substrate.
   - Plants were irrigated when moisture level dropped to 45% container capacity (CC) based on container weight. Average day temperature was 25.3°C. Root length, root and shoot dry mass were measured after 4 weeks of growth.
   - In a parallel “moisture level trial”, geranium were subirrigated with oxygenated or tap water with plants being irrigated under normal (45% CC) or wet (80% CC) conditions.

![Finished plant trial](image)

Fig. 4. No effect of oxygenation was observed on root or shoot growth on lobelia (shown) or other species.

![Finished plant trial](image)

Fig. 5. Oxygenation did not affect root or shoot growth of geranium grown with normal (left) or wet (right) substrate moisture levels.

**Key findings:**
- No differences in root growth were observed when ambient or oxygenated water was applied through top-watering or subirrigation for the three bedding plant species.
- There were no differences in root growth for the geranium sub trial with two levels of moisture management (45% or 80% CC) for ambient or oxygenated water applied through subirrigation.

**How can you use this information?**
- The super-saturated DO levels in irrigation water did not enhance root or plant growth compared to ambient tap water during the propagation and finished plant trial.
- Do not over water. Allowing plants to dry between irrigations will shift the balance between water-filled to air-filled pores supplying adequate oxygen to roots.

Acknowledgements: We thank our industry partners in the Floriculture Research Alliance (FloricultureAlliance.org) for their support. This material is also supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, "Clean WaterR" - Reduce, Remediate, Recycle", #2014-51181-22372.