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### **The Myth of Root Snorkels:**

*"Low-oxygen root zones can be aerated by installing vertical aeration tubes"*

#### **The Myth**

One of the oddest and increasingly frequent practices I've seen is the incorporation of vertical plastic pipe during street tree installation. These aeration tubes are required in some cities' planting specs, specifically for street trees in public right-of-ways, sidewalk planter pits, planting strips, and medians. The 3-4" plastic pipes are sometimes perforated and run from the bottom of the planting hole to the soil surface. Pipes are left empty and uncapped, or filled with pea gravel. Proponents claim that the tubes increase oxygen supply to the roots, allow evaporation of excess moisture, and can assist in efficient summer watering. In urban areas with compacted soils, proponents argue this practice will improve street tree establishment and survival. Can root "snorkels" rescue oxygen-starved street trees?

#### **The Reality**

Aeration tubes have been used successfully and most commonly in liquid environments, such as aquaria, hydroponic greenhouses, and waste water treatment plants. In these systems, there is active oxygen delivery via a pump or other aerating device. In contrast, aeration pipes in soil environments are a passive transfer mechanism, where oxygen diffuses from the atmosphere into the soil surrounding the pipes.

The origin behind this practice is difficult to trace. A lone study more than 20 years old suggested that perforated pipe was effective in oxygenating container trees. More recently, a handful of studies have investigated the use of aeration pipes in field situations. Most of these have focused on phytoremediation of contaminated soil and efforts to improve tree root growth in these sub-optimal conditions. Aeration tubes were not found to be useful in either improving plant growth or root development of *Populus* spp. (a genera known for vigorous root growth); researchers concluded that "passive oxygen addition appeared to have little effect on root density."

The most relevant research to date comes from Davis, California and focuses on usage of aeration tubes in both greenhouse and field situations. The results from the greenhouse study reported "that there is no positive effect of the pipe on ODR (oxygen diffusion rate) in the base soil." Field experiments are ongoing but initial data echoes the greenhouse study. It appears that passive aeration of root zones is not effective in anything but container trees.

A potentially useful installation technique that would merit more study is the use of oxygen releasing compounds (ORCs) in poorly oxygenated soils. These compounds have been used effectively to deliver oxygen to beneficial microbes used for oil spill treatment and other environmental remediation. Those earlier researchers working with *Populus* spp. found that ORCs increased root densities, while passive means were unsuccessful. This technique not only delivers oxygen to tree roots, but to beneficial microbes needed to colonize roots as well. Use of ORCs might be enough of a one-time boost to initiate root growth and increase successful tree establishment.

Finally, there are a number of management practices that can improve soil aeration and root health. Many of these need to be observed at the time of installation (e.g. working when the soil is dry and reducing compaction from people and equipment), and others can be instituted at any time (e.g. increasing organic mulch). Any practice that reduces soil compaction will increase aeration and drainage.

### **The Bottom Line**

- No scientific evidence suggests that passive aeration pipes will improve soil oxygen levels in field situations.
- Tree installation costs are unnecessarily increased by specifying installation of aeration tubes.
- Chemical oxygen-releasing compounds can increase oxygen concentrations in root zones and markedly improve root growth.
- Proper management of landscape soils during and after tree installation can improve gas transfer throughout the root zone.

For more information, please visit Dr. Chalker-Scott's web page at <http://www.theinformedgardener.com>.