MERCHANT'S GARDEN

CLIMATE-SMART URBAN AGRICULTURE

SUPPORTING HISTORICALLY UNDERSERVED PRODUCERS

www.merchantsgarden.com

THE SCIENCE

Plants use oxygen for aerobic respiration to create energy in the form of glucose. Respiration occurs at all times, but the rate increases at night due to the halt of photosynthesis. Roots themselves serve in respiration, as they absorb oxygen from the surrounding space. Not only dose dissolved oxygen aid in respiration but allows for nutrient uptake. Oxygen allows for nutrients to pass through the cell wall and into roots. As a general rule, as oxygen levels increase so dose nutrient absorption.

Aerobic bacteria serve a major function in hydroponic and aquaponic systems by breaking down organic materials into simpler components that the plant may uptake. (BOD) Biochemical Oxygen Demand is a metric used to show the required dissolved oxygen to supply these bacteria at any specific time. Depending on the system, time established, and filtration method used the BOD metric will change. Growers relying on organic forms of nutrition would require a higher BOD, therefore a higher ppm of dissolved oxygen.

OXYGENS
ROLE IN PATHOGENS

Fungus pythium is one of the most common and destructive fungal pathogens a hydroponic & aquaponic grower may face. It can be identified by the roots turning from airy white to firm and brown. A relationship has been known between a lower concentration of oxygen and an increased rate of fungal growth. Below 4ppm plants become susceptible, and the plant will be starved of oxygen and therefore nutrition

Basil roots at Merchants Garden before and after increase of DO

SOLUTIONS TO
IMPROVE DO

- Maintaining cold water temperature (Water temperature & DO inversely related)
- Using air stones (Air from a compressor bubbling out of a porous air stone)
- Using an Oxygenator (Specifically designed for commercial growers to saturate water with oxygen)
- Using splashing, churning, or utilizing system design (An unconventional approach to physically introduce air into water, waterfalls, pressurized plumbing ect...)

SOURCES

- https://www.growopportunity.ca/the-end-zone/
- https://www.urbanforestdweller.com/roots-and-respiration/#:~:text=One%20of%20the%20most%20surprising%20things%20to%20learn,are%20used%20to%20create%20energy%20for%20cell%20growth.
- https://www.maximumyield.com/strengthening-your-plants-roots/2/2641#:~:text=Like%20other%20organisms%2C%20plants%20need%20oxygen%20to%20perform,cellular%20respiration%20that%20requires%20oxygen%20and%20releases%20CO2.

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These efforts are seen, appreciated, and of the utmost importance.

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