

The Importance of Oxygen & Quality Water

Why Plants Grow Better with Rainwater

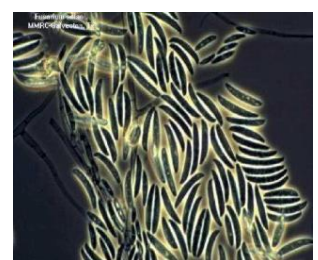
Composition

- **Rainwater:** $H_2O + O_3 + H_2O_2 + N_2 = O_5, O_7, O_{11} \dots \dots \dots O_x$
- **Irrigation Water:** Metals, Minerals, Salts, Chemicals, Fertilizer, Biomaterial, Disease Agents and Oxygen
- **Core Difference:** (Deficient) Oxygen and Water Quality



Irrigation Water

- Contains metals (Fe, Mg, Mn & Zn), minerals and salts which negatively impacts water and mineral uptake, thus influencing respiration, transpiration and photosynthesis
- Contaminated with pathogens (nematodes, bacteria, viruses, and fungi)
- Could be contaminated with fertilizer and chemicals
- Contains biomaterials
- Can react with irrigation systems and cause corrosion
- Contributes to soil compaction
- Affects the soil pH
- Leads to mineral sediment build-up in irrigation systems, thus contributes to reduced flow rates and under-watering
- Ideal environment for bacterial and fungal growth in irrigation systems



Plant Physiology

Photosynthesis

- The process of capturing light energy and converting it to sugar energy in the presence of chlorophyll using carbon dioxide and water

Photosynthesis:
Carbon Dioxide + Water + Light = Glucose + Oxygen
(Water Quality = Improved Photosynthesis)

Respiration

- The process of metabolizing (burning) sugars to yield energy for growth, reproduction and other life processes

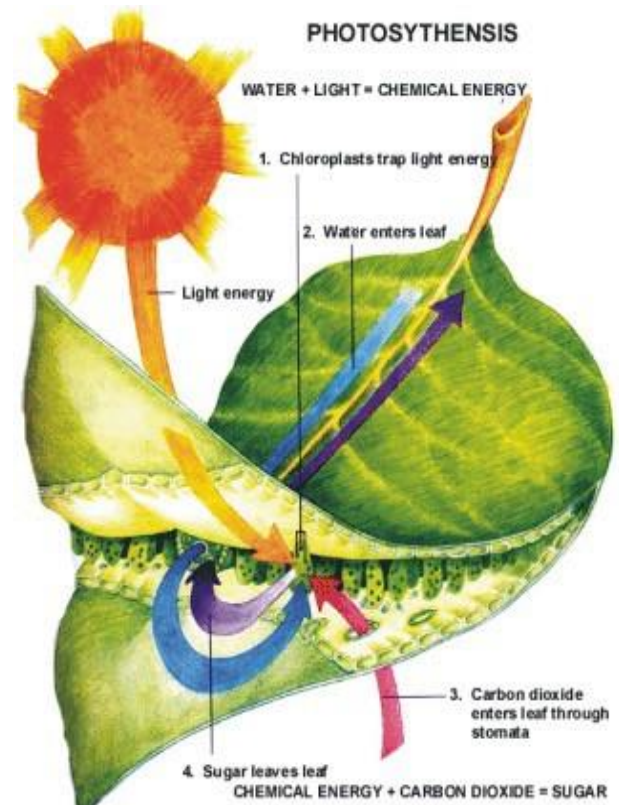
Respiration:
Glucose + Oxygen = Energy + Carbon Dioxide + Water
(Higher Oxygen Levels = Effective Respiration)

Transpiration

The loss of water vapour through the stomata of leaves

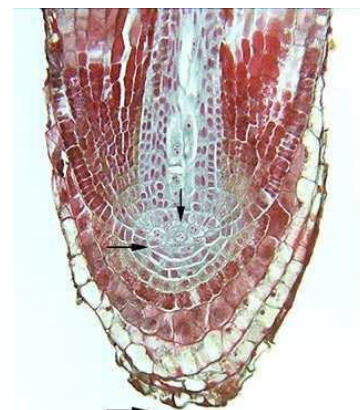
Assists with:

- The movement of minerals and sugars throughout the plant
- The cooling of the plant
- The turgor pressure to maintain cell shape and plant structure



The Importance of Oxygen and Nutrient Uptake

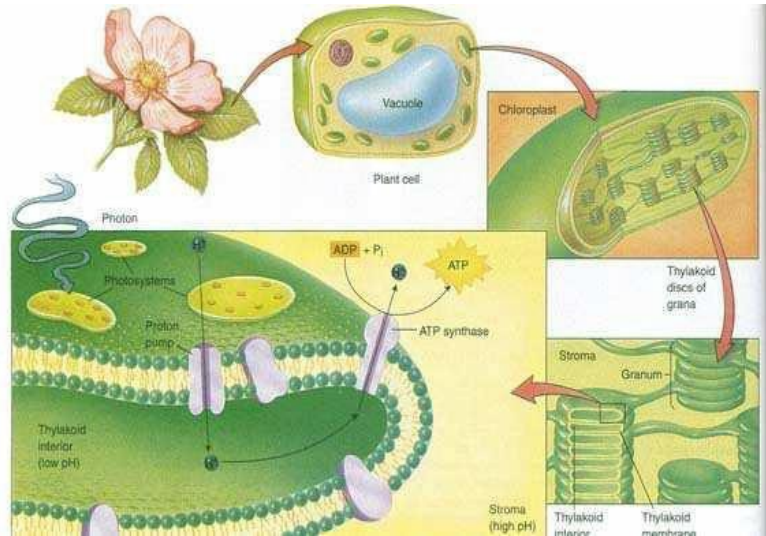
- Roots supplied with sufficient oxygen can absorb nutrient ions selectively from the surrounding solutions as required.
- The metabolic energy required to drive nutrient uptake, is obtained from root respiration using oxygen.
- Insufficient oxygen affects the metabolism of glucose and therefore limits water and nutrient uptake for optimal growth and development.
- High oxygen levels ensure healthy root tips that can take up the required levels of Calcium for new tissue growth and development.
- Calcium is absorbed mainly by the root apex (growing tip).
- The root apex has a large energy (and oxygen) requirement for new cell production and growth.
- If root tips begin to suffer from a lack of oxygen, a shortage of Calcium in the shoot will occur.
- Calcium shortages make the development of Calcium disorders such as tip burn and blossom end rot of fruit more likely and severe under oxygen starvation conditions.





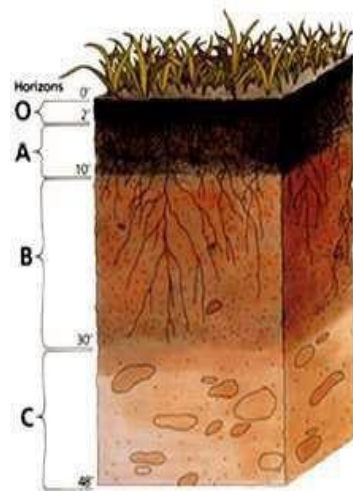
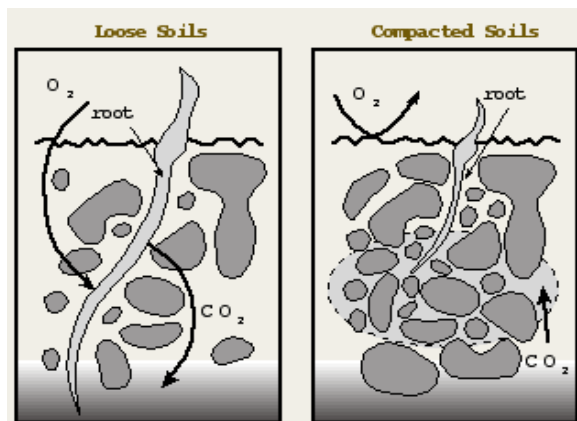
Insufficient Oxygen in the Root Zone

- Reduces water and mineral nutrient uptake
- Reduces root and plant growth
- Affects yield and quality
- Reduces photosynthesis and glucose transfer
- Wilting under heat stress conditions
- Accumulation of toxins
- Plants produce a stress hormone, Ethylene, which accumulates in the roots and causes collapse of the root cells.
- At this stage pathogens such as Pythium and Phytophthora can easily take hold and destroy the plant.



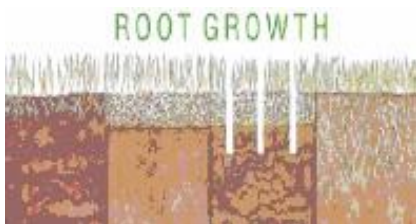
In Soil with Sufficient Oxygen and Aeration

- Pore spaces between soil particles are maintained, thus reducing compaction
- The structure of the soil improves
- Surface and subsurface crusting are prevented
- The infiltration and movement of water and fertilizer improve
- The hydraulic conductivity is strengthened
- The drainage of water improves
- The decomposition of organic matter and thatch intensifies
- Decomposition rate increases by up to 35%
- The effectiveness of applied fertilizer and products increases
- The incorporation of organic matter in the soil improves and contributes to soil stability
- The tolerance to heat and cold conditions improves



In Soil with Compaction and Limited Oxygen

- Germination of seeds as well as seedling emergence are slowed down and variable
- Roots will develop in the top section of the soil profile with limited mass and hair roots
- Roots are shallow and malformed which can lead to moisture stress, nutrient deficiencies and lodging
- Plants will not respond to fertilizer applications
- Roots will not be able to produce the energy needed for nutrient uptake
- Plants become up to 60% more vulnerable to nutrient deficiencies like Nitrogen and Potassium deficiencies
- Compaction can contribute up to 80% of plant disorders
- Plants in dense soil can become up to 70% more susceptible to disease infections
- Yield can be affected by up to 60%



The Importance of Oxygen and Microorganisms

- Positive microorganisms are responsible for up to 65% of the breakdown of organic matter, it assists with water and nutrient uptake and also with root protection.
- Oxygen is necessary for the respiration of Mycorrhiza, Trichoderma and earthworms for the breakdown of organic matter.
- Carbon dioxide is formed during respiration of root cells and microorganisms, as well as from the decomposition of organic matter.
- Aeration diffuses carbon dioxide away from the roots to the surface.
- The accumulation of carbon dioxide will lead to the suffocation of roots and aerobic microorganisms. Low oxygen concentrations and high levels of carbon dioxide influence the effectiveness and activeness of aerobic microorganisms.

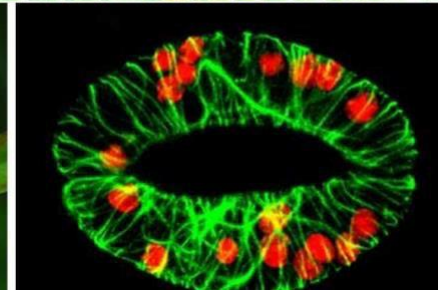




AgriWater

The Importance of Water in Plant Growth

- Water is the primary component of photosynthesis, respiration and transpiration
- Responsible for turgor pressure in cells, which is needed to maintain cell shape and proper plant structure and ensures healthy cell growth
- Water deficiencies will result in wilting
- The medium in which most biochemical reactions take place
- The solvent to move mineral nutrients from the soil up the plant
- The solvent to move products of photosynthesis throughout the plant, including down to the root system
- Helps to maintain equilibrium of the dissolved substances passing through the membranes of cell walls
- Responsible for temperature regulation and cooling of leaves as it evaporates from leaf tissue during transpiration
- Regulator for stomata opening and closing, thus controlling transpiration and to some degree photosynthesis
- Source of pressure to move roots through the soil
- Comprises up to 80% or more of a plant's weight
- Water assists with the flushing of pore spaces in the soil



Increase the OXYGEN LEVELS in your irrigation water, soil, medium and root zone and see the results!

