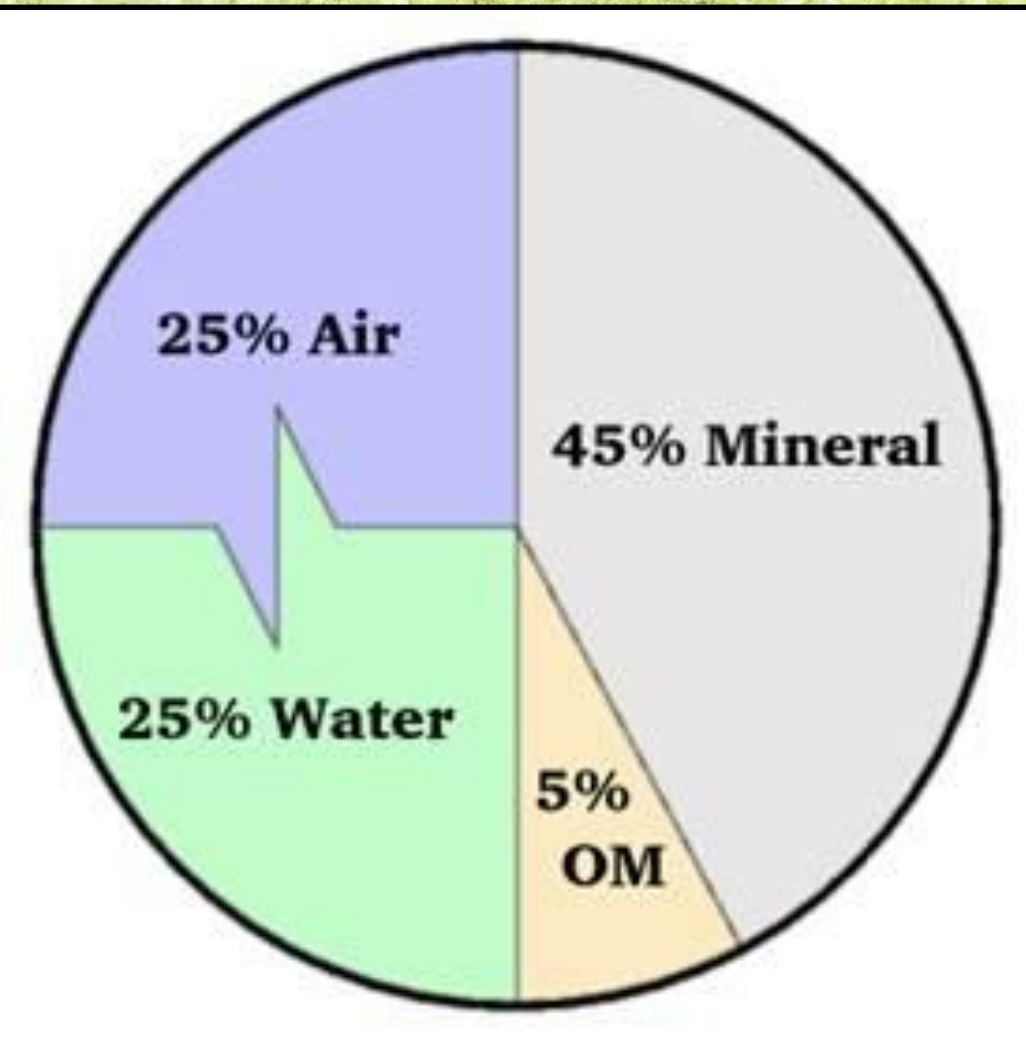


A close-up photograph of a pile of bonsai soil and gravel. The soil is a mix of dark brown and grey particles, with many small, light-colored gravel pieces interspersed. The pile is set on a light-colored, sandy surface. The text "Bonsai soil and micro-managing microbiota" is overlaid in the center in a bold, orange font with a white outline.

**Bonsai soil and
micro-managing
microbiota**

Natures Ideal Soil Composition



- Mineral = Sand, Silt, Clay
 - Pumice, Scoria, Turface or Akadama
- OM = Organic Matter
 - Sphagnum moss, organic fertilizer, bark, compost
- Water = H₂O
 - Quality concerns
- Air = air filled pores
 - Importance for sifted bonsai soil

Perched Water Table

- Perched water tables exist in all container planting
- Exist in the container where the forces of cohesion and adhesion become stronger than gravitational force.
- The size and shape have no effect on the height of the perched water table.
- The only way to lower the height of the perched water table is to increase substrate/ soil particle size.
 - The above is why it is critical to screen bonsai soil components.



Bonsai Soils

- Granular in nature with particle size 1/8 - 1/4 inch
 - Eliminates or greatly reduces perched water table
- Hybridized aeroponics/ hydroponics
 - Root sauna
- Maximized surface area given small container size
- Maximized cation exchange capacity within small container
- **A highly functioning organic ecosystem**

Mycorrhizal fungi advantages

- **Increases rooting area by up to 50 times**
- **Occupies infection points on roots, acting like hired security for the plant.**
- **These symbiotic relationships have evolved over the past millennia**
 - **Work in parallel seasonal schedules and time tables**
- **Continually add organic glues and fungal hyphae, which improve structure and help fluff the soil**

Feeding the Soil for Vitality

- **Compost = C:N ratio of 30:1**
 - More carbon = more fungal
 - More nitrogen = more bacterial
 - Nitrogen → Nitrate = easily absorbed then processed into ammonium
 - → Ammonium = easily absorbed and used as is, preferred by conifers with ectomycorrhizal (ECM) fungi
- **Synthetic versus organic fertilizers**
 - Synthetic = mineralized and ready for plant uptake
 - Organic = compounds that need to be mineralized before uptake
- **Kelp is high in cytokinin which will help increase ramification**
 - Cold pressed, or enzymatically digested are best
 - High in micronutrients and cytokinins
- **Biogold NPK = 5.5 – 6 – 3, with calcium, magnesium, natural vitamins and other minerals**
- **Humic acid and humates**
 - Help balance pH in range where molecules are more absorbable
 - Act as major buffer in the soil

Substrate properties

Substrate Characteristics	Akadama	Screened Akadama	Turface	Screened Turface	Screened Pumice	Screened Lava	Screened Pine Bark	Screened BioChar	Screened Mix	Ideal Range
Effective Porosity	55%	55-57%	57%	67%	50%	52-65%	65%	67%	57-62%	55-65%
Air/ Saturated porosity	17-35%	32-35%	17%	27%	32%	38-42%	35%	42%	32-42%	25-45%
Water/ Field Capacity	20-38%	20-25%	40%	40%	18%	14-23%	30%	25%	25-20%	18-28%
CEC/ Cation Exchange Capacity	18-20	18-20	33-35	33-35	75	15-40	30-74			50-100

Additional bonsai soil substrate options

Inert/ inorganic

- Granular humates
 - CEC = 450
- Diatomaceous earth
- Basalt paramagnetic?
- biochar

Organic

- Bark
- Compost
- fungi

**No single component on its own
will make for a great substrate**

The crux of plant and soil coevolution

- **Soil microbiota feed on organic matter shed by the tree, surrounding plant life, and soil parent material.**
- **Organic material/ leaf and branch litter naturally regulate the type of soil microbiota that are up regulated in the rooting zone.**
- **This in turn dictates the types and amounts of nutrients fed to the tree from the symbiotic relationships with the microbiota**
- **SO... this micro ecosystem has evolved to become a self managing system.**

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