

Soil is the unconsolidated mineral or organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants. (USDA)

Soil is complex and dynamic.

It supports and anchors plants, provides nutrients, allows for air & water for plants' roots. healthy soil produces healthy plants with natural resistance to diseases and pests.

½ solid matter (45% mineral, 5% organic matter), ½ pore space (25% air, 25% water)

Soil Air 25%: Oxygen for soil organisms, atmospheric Nitrogen utilized by plants, penetration of roots, plant exchange of oxygen & carbon dioxide, good soil structure. Avoid soil compaction, minimal tillage, don't work wet soil!

Increase aeration: minimal digging and turning of soil, activity of earthworms and other organisms, addition of organic matter.

Soil Water 25%: water moves through soil, with mineral particles, nutrients, humus.

too dry: plants & organisms die;

too wet: lack of oxygen kills organisms & rots roots.

irrigation: rainwater, spray, drip, furrow, hand-watering.

Soil Minerals 45%: rocks disintegrate over time; contain elements for plant nutrition.

Particles grouped according to size: Sand, Silt, Clay

Sand: particle size 0.05-2mm in diameter; feels gritty.

Individual particles visible to the naked eye, large pore spaces, fast drainage

Silt: particle size 0.002-0.05mm in diameter; feels smooth and silky. intermediate in size and properties

Clay: particle size <0.002mm in diameter; feels sticky greatest surface area, negatively charged particles (CEC),

hold onto water and nutrients, yet sometimes so tightly that they become unavailable to plant roots; small particles can be so tightly packed that air cannot reach the roots.

Soil Texture: size range of particles; relative proportions of sand, silt, clay

Soil pH: measure of acidity to alkalinity: 0-14 determines solubility & availability of soil nutrients, affects activity of soil microorganisms,

most favorable for plant growth: 5-7; Santa Clara County: 6.5-8

adjusting pH: can help acidify soil by addition of amendments/mulches such as compost, sulfur, peat, coffee grounds, redwood bark, pine needles.

Nutrients

primary nutrients: Nitrogen, Potassium, Phosphorus (NPK)

secondary nutrients: Calcium, Magnesium, Sulfur

micronutrients: Boron, Chlorine, Copper, Iron, Manganese, Molybdenum, Nickel, Zinc

Soil Organic Matter 5%: plant and animal residues in various stages of decomposition, living organisms; humus is completely decomposed stable organic matter.

Organic matter needs to be continually renewed as it is used by plants and organisms.

Benefits of Soil Organic Matter: provides nutrients for plants, feeds soil organisms and increases their numbers and diversity, improves water flow and retention, improves aeration, promotes better soil structure through formation of stable aggregates.

Soil Amendments:

Compost: decomposition of plant materials

build pile one cubic yard, in bin if available; mix cut-up plant material in proportions, by volume, of 50% “green” (harvested live, such as grass clippings) and 50% “brown” (dead, such as fallen leaves); add water to consistency of wrung-out sponge; and turn regularly to aerate until reduced to compost.

Worms: castings from vermicomposting, aeration of soil, movement of organic matter.

Animal Manures: from herbivores, well-composted if planting soon;

fresh manure can be put on beds or dug in during the off-season; high in Nitrogen.

Also grass-cycling, alfalfa, bone meal, fish emulsion, kelp meal, etc.

Mulching: holds in moisture, moderates temperature, reduces weed competition, controls erosion, e.g., bark, newspaper, straw, manure, grass clippings, pine needles, etc.

Cover Crops: organic matter to dig in or compost, Nitrogen-fixing legumes, cover bare soil to prevent erosion, roots loosen and aerate soil.

Crop Selection and Rotation: replace depleted nutrients, avoid soil-borne diseases, condition soil with roots, capture nitrogen from atmosphere, grow compost crops.

Fertilization: feed plants vs. feed soil

synthetic fertilizers: readily available to plants; can burn plants and kill soil organisms. organic

fertilizers: slow release over longer period of time; benefit soil organisms.

Container Gardening: looser soil, drainage important, more frequent addition of nutrients, leaching to prevent toxic buildup

Remember: Organic matter! Organic matter! Organic matter!