

**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!**