**Chemical Properties of Soil**

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**Chemical properties of soil:**

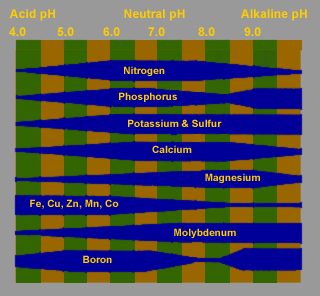
1. pH
2. Salinity (EC)
3. Cation Exchange Capacity (CEC)
4. Organic Matter
5. C:N ratio (Carbon to Nitrogen)

**Soil pH**

* A measure of the acidity or alkalinity of a soil.
* Neutral = 7.0
* Acidic < 7.0
* Alkaline > 7.0
* Logarithmic scale which means that a 1-unit drop in pH is a 10-fold increase in acidity.

**Soil pH and plant growth**

* Affects availability of plant nutrients (in general, optimal pH is between 5.5-7.5)
* Low pH soils (<6.0) results in an increase in Al. Aluminum is toxic to plants
* Affects availability of toxic metals (in general, more available in acidic soils)
* Affects the activity of soil microorganisms, thus affecting nutrient cycling and disease risk

**Nutrient Availability**  


**Increasing soil pH:** Liming materials (pure calcium carbonate or dolomitic lime) will increase soil pH.

1. Lime is a certified organic product
2. Slow-release product. Do not add every year.
3. 15-25 lbs lime per 1000 sq ft is recommended

Wood ashes are another product to raise soil pH. They also are a source of K, Ca, and Mg. Some compost also can increase soil pH.

**Gypsum** is calcium sulfate. It is not a substitute for lime, and has little effect on soil pH. Gypsum only improves structure in soils that have extremely high sodium contents (rare in the NW).

**Decreasing soil pH:** Some plants thrive under acidic conditions (ex. rhododendrons, blueberries, and azaleas). Elemental sulfur is often recommended (50 lb S per 1000 sq. ft). Ammonium and ammonium-forming N fertilizers will also result in a decrease in soil pH.

**Soil salinity**

* Potential problem in irrigated soils due to high evaporation rates and low annual rainfall leaving salts to accumulate.
* Salts can come from irrigation water, fertilizers, composts, and manure.
* Salts can be leached by slowly applying excess water.
  + Three inches removes about 50% of the soluble salts.
  + Five inches removes about 90%.

**Soil Salinity and Interpretation**

|  |  |
| --- | --- |
| Conductivity(mmho/cm) | Interpretation |
| 4 or above | Severe accumulation of salts. May restrict growth of many vegetables and ornamentals. |
| 2 to 4 | Moderate accumulation of salts. Will not restrict plant growth, but may require more frequent irrigation. |
| less than 2 | Low salt accumulation. Will not affect plants. |

**Cation-Exchange Capacity**

A cation is a positively charged ion. Most nutrients are cations: Ca2+, Mg2+, K +, NH4 +, Zn2+, Cu2+, and Mn2+. These cations are in the soil solution and are in dynamic equilibrium with the cations adsorbed on the surface of clay and organic matter. CEC is a measure of the quantity of cations that can be adsorbed and held by a soil.

CEC is dependent upon the amount of organic matter and clay in soils and on the types of clay. In general, the higher OM and clay content, the higher the CEC.

**Soil organic matter**

Soil organic matter (SOM) comprises an accumulation of

1. Partially disintegrated and decomposed plant and animal residues.
2. Other organic compounds synthesized by the soil microbes upon decay.

OM content of a well drained mineral soil is LOW: 1 – 6 % by weight in the top soil and even less in the subsoil.

**Sources of Soil Organic Matter:**   
The primary sources of SOM are - plant tissues

1. The tops and roots of trees
2. Shrubs, grasses, remains of harvested crops and Soil organisms

Animals are secondary sources of Organic Matter.

1. Waste products of animals
2. Remains of animals after completion of life cycle

**Humus**

Humus is a complex and rather resistant mixture of brown or dark brown amorphous and colloidal organic substance that results from microbial decomposition and synthesis and has chemical and physical properties of great significance to soils and plants.

**Humus Formation**

The humus compounds have resulted from two general types of biochemical reactions: Decomposition and Synthesis.