New Start Community Garden

Garden Curriculum

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NEW START COMMUNITY GARDEN

GARDEN CURRICULUM

The purpose of this curriculum is to provide educational materials to support student and community visitors to the New Start Community Garden, aka the Shark Garden. It is designed for ages 10 and up and many lessons and activities can be used at home as well as in the garden. Our goal is to create inclusive curriculum that encourages sustainable organic gardening, environmental stewardship, and multicultural appreciation for food. For more information about the Shark Garden, contact info@sharkgarden.org

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Soil Biology & Importance

In most ecosystems, more life and diversity exists underground than above. The soil is home to a vast array of organisms, including bacteria, cyanobacteria, algae, protozoa, fungi, nematodes and mites, insects of all sizes, worms, small mammals and plant roots.

Soil is the outer loose layer that covers the surface of Earth. Soil quality is a major determinant, along with climate, of plant distribution and growth. Soil quality depends not only on the chemical composition of the soil, but also the topography (regional surface features) and the presence of living organisms. In agriculture, the history of the soil, such as the cultivating practices and previous crops, modify the characteristics and fertility of that soil.

Soil develops very slowly over long periods of time, and its formation results from natural and environmental forces acting on mineral, rock, and organic compounds. Soils can be divided into two groups: organic soils are those that are formed from sedimentation and primarily composed of organic matter, while those that are formed from the weathering of rocks and are primarily composed of inorganic material are called mineral soils. Mineral soils are predominant in terrestrial ecosystems, where soils may be covered by water for part of the year or exposed to the atmosphere.

Soil consists of these major components:

- inorganic mineral matter, about 40 to 45 percent of the soil volume
- organic matter, about 5 percent of the soil volume
- water and air, about 50 percent of the soil volume

The amount of each of the four major components of soil depends on the amount of vegetation, soil compaction, and water present in the soil. A good healthy soil has sufficient air, water, minerals, and organic material to promote and sustain plant life.

The organic material of soil, called humus, is made up of microorganisms (dead and alive), and dead animals and plants in varying stages of decay. Humus improves soil structure and provides plants with water and minerals. The inorganic material of soil consists of rock, slowly broken down into smaller particles that vary in size. Soil particles that are 0.1 to 2 mm in diameter are sand. Soil particles between 0.002 and 0.1 mm are called silt, and even smaller particles, less than 0.002 mm in diameter, are called clay. Some soils have no dominant particle size and contain a mixture of sand, silt, and humus; these soils are called loams.

Soil Functions

Role of soil organisms

Soil organisms play critical roles in plant health and water dynamics. Processes that soil organisms contribute to include:

- Nutrient cycling.
- Nutrient retention.
- Water infiltration and water-holding capacity.
- Disease suppression.
- Degradation of pollutants.
- Increasing the soil's biological diversity.
- Improving soil structure.

Soil biological processes are responsible for supplying approximately 75 percent of the plant-available nitrogen and 65 percent of the available phosphorus in the soil.

Like all organisms, those inhabiting soil need food and a favorable environment. Adequate organic matter content, ample aeration, moderate moisture, neutral pH and warm temperatures all favor increased microbial activity.

Benefits of organic matter

By maintaining a high soil organic matter content, food and a favorable habitat can be built for a diverse community of soil organisms. Not only does organic matter provide good habitat, but it also greatly benefits chemical and physical soil characteristics.

Moisture, pH, nutrient supply and the biological community are all more stable, or buffered, as soil organic matter increases. Organic material also helps maintain soil porosity, which is essential because most beneficial soil microbes and processes are aerobic, meaning they require oxygen.

Soil Functions (Continued)

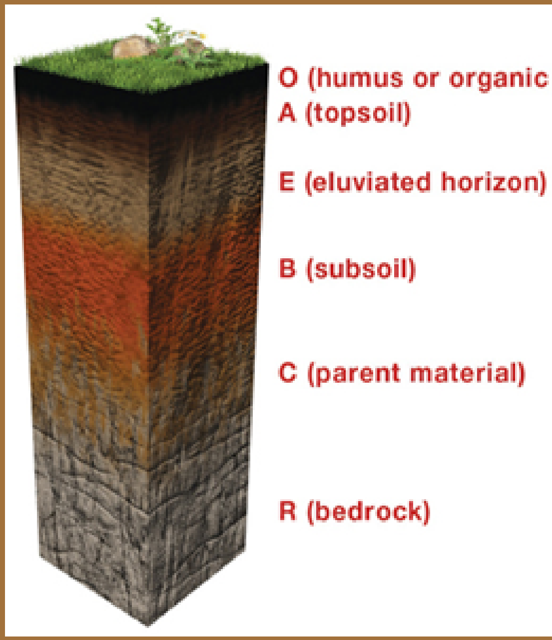
Soil performs many critical functions in almost any ecosystem (whether a farm, forest, prairie, marsh, or suburban watershed). There are seven general roles that soils play:

- Soils serve as media for growth of all kinds of plants.
- Soils modify the atmosphere by producing and absorbing gases (carbon dioxide, methane, water vapor, and the like) and dust.
- Soils provide habitat for animals that live in the soil (such as groundhogs and mice) to organisms (such as bacteria and fungi), that account for most of the living things on Earth.
- Soils absorb, hold, release, alter, and purify most of the water in terrestrial systems.
- Soils process recycled nutrients, including carbon, so that living things can use them over and over again.
- Soils serve as engineering media for construction of foundations, roadbeds, dams and buildings, and preserve or destroy artifacts of human endeavors.
- Soils act as a living filter to clean water before it moves into an aquifer.

Soil Profile

Soil Profile

There are different types of soil, each with its own set of characteristics. Dig down deep into any soil, and you'll see that it is made of layers, or horizons (O, A, E, B, C, R). Put the horizons together, and they form a soil profile. Like a biography, each profile tells a story about the life of a soil. Most soils have three major horizons (A, B, C) and some have an organic horizon (O).



(Soil Biology)

The horizons are:

O – (humus or organic) Mostly organic matter such as decomposing leaves. The O horizon is thin in some soils, thick in others, and not present at all in others.

A - (topsoil) Mostly minerals from parent material with organic matter incorporated. A good material for plants and other organisms to live.

E – (eluviated) Leached of clay, minerals, and organic matter, leaving a concentration of sand and silt particles of quartz or other resistant materials – missing in some soils but often found in older soils and forest soils.

B – (subsoil) Rich in minerals that leached (moved down) from the A or E horizons and accumulated here.

C – (parent material) The deposit at Earth's surface from which the soil developed.

R – (bedrock) A mass of rock such as granite, basalt, quartzite, limestone or sandstone that forms the parent material for some soils – if the bedrock is close enough to the surface to weather. This is not soil and is located under the C horizon.

Soil Test Analysis

Let's Get Our Hands Dirty by digging and testing the different components of the soil in the garden or even your backyard!

Soil is a medium comprised of soil particles, organic matter, water, air, and living organisms, all of which are important to the overall health of the soil and the plants that grow in it. The three primary soil particles are sand, silt, and clay. The relative percentages of these components present make up the soil's texture. The texture is important to overall soil and plant health as it relates to soil porosity, which refers to the pore spaces where air and water reside.

The ideal soil texture is a mix of sand, silt, and clay particles, known as a loam. However, in most cases, the particles will not be balanced, and the soil will need to be altered by adding organic amendments. To evaluate soil texture, use a simple jar test to determine the percentages of sand, silt, and clay. Once the percentages are calculated, the soil textural triangle can be used to determine the soil type.

Purpose:

The purpose of this soil analysis is to test what items are made up of different types of soil. This soil test is used to analyze how healthy and nutrient dense the soil is so that our garden planning or planting can be ideal for the plants that are grown.

Estimated time: 1 Hour & 30 Minutes (1 Hour Practice & 30 Minute Discussion)

Soil Test Analysis

Materials:

- Straight-edged, clear jar
- Permanent marker
- Ruler
- Watch or stopwatch
- 1 tablespoon of powdered dishwashing detergent
- Mesh sieve or old colander

(Jeffers. A)

1) Using a mesh sieve or old colander, sift the soil to remove any debris, rocks, and large organic matter (leaves, sticks, roots, etc.).
2) Fill the jar ⅓ full of the soil to be tested

(Jeffers. A)

3) Fill the remainder of the jar with clean water but leave some space at the top.

(Jeffers. A)

4) Add 1 tablespoon of powdered dishwashing detergent
5) Cap the jar and shake vigorously until the soil turns into a uniform slurry.
6) Set on a level surface and time for one minute.
7) Place a mark on the outside of the jar, showing the coarse sand layer settled at the bottom of the jar.

Soil Test Analysis

(Jeffers. A)

8) Leave the jar in a level spot for 2 hours.
9) Mark the top of the next settled layer with the permanent marker. This is the silt layer.

(Jeffers. A)

10) Leave the jar on a level spot for 48 hours.
11) Mark the top of the next settled layer with the permanent marker. This is the clay layer that has settled on top of the silt layer.

(Jeffers. A)

12) Using a ruler, measure and record the height of each layer and the total height of all three layers. Use the soil texture analysis worksheet below to record the results.

13) Use the soil texture triangle to estimate the soil type for the site.

A) The clay percentages are listed on the left side of the triangle. Lines corresponding to clay percentages extend from the percentages reading left to right (see red line).

B) The silt percentage is on the right side, with lines extending downwardly, diagonally from right to left (see green line).

C) The sand percentage is on the right side, with lines extending upwardly, diagonally from right to left (see blue line).

14) Track the lines with the percentages measured and find the spot on the triangle where all three lines intersect. The region where these lines intersect indicates the soil type present. The example shown represents a loam soil texture.

The longer you allow the jar of soil to sit for the experiment, the better the layers will be defined.

Soil Test Analysis

Now that we've completed the soil test, it's now time to see how much clay, sand, and silt are components in the soil so we can know how much organic matter and particles are needed to make the best quality soil for our plants and garden produce!

Soil Texture Analysis "The Jar Test" Worksheet
Measurements

Height of sand layer _____inches / cm

Height of silt layer _____inches / cm

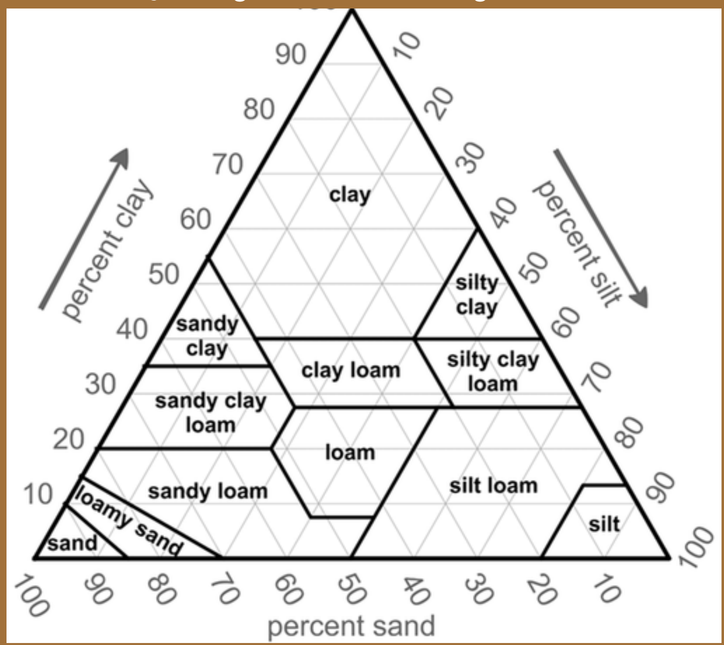
Height of clay layer _____inches / cm

TOTAL HEIGHT OF LAYERS _____inches / cm

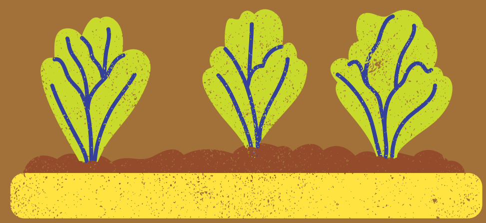
% SAND=(sand height)/(total height) x 100 =_______ % SAND

% SILT=(silt height)/(total height) x 100 =_______ % SILT

% CLAY=(clay height)/(total height) x 100 =_______ % SILT



(Jeffers, A)



Use this easy diagram to figure out the quality and percentage of your backyard, garden, or plant soil!

Soil Composition

Now that we've figured out what type of soil we have after the analysis test, let's discuss the ideal conditions for garden and plant soil! Soil is formed by different particles such as gravel, rock, sand, silt, clay, loam and humus.

Sand

It is most extensively used construction material. It consists of particles of rock and hard minerals, such as silicon dioxide. They are the largest type of soil particles, where each particle is visible to naked eye. The large, relatively stable sand-particle size increases soil aeration improves drainage in tight soils and creates plant-growth supporting qualities, or tilt.

Silt

Silt is a sediment material with an intermediate size between sand and clay. Carried by water during flood it forms a fertile deposit on valleys floor. Silt is a non plastic or low plasticity material due to its fineness. Due to its fineness, when wet it becomes a smooth mud that you can form easily into balls or other shapes in your hand and when silt soil is very wet, it blends seamlessly with water to form fine, runny puddles of mud.

Soil Composition

Clay

Clay particles are the finest of all the soil particles, measuring fewer than 0.002 mm in size. It consists of microscopic and sub-microscopic particles derived from the chemical decomposition of rocks. Clay is a fine grained cohesive soil. They stick together readily and form a sticky or gluey texture when they are wet or dry. Clay expand when in contact with water and shrink when getting dry. Compared to sand particles, which are generally round, clay particles are thin, flat and covered with tiny plates. Organic clay is highly compressible and its strength is very high when dry, which is why it is used in construction as mud mortar.

Loam

Loam is a mixture of clay, sand and silt and benefits from the qualities of these 3 different textures, favouring water retention, air circulation, drainage and fertility. These soils are fertile, easy to work with and provide good drainage. Depending on their predominant composition they can be either sandy or clay loam. The way the other particles combine in the soil makes the loam. For instance, a soil that is 30 percent clay, 50 percent sand and 20 percent silt is a sandy clay loam, with the soil types before "loam" listed in the order their particles are most dominant in the loam. The labels “clay loam,” “silt loam” and “sand loam” are used to refer to soils that are composed predominantly of those ingredients.

Sources

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