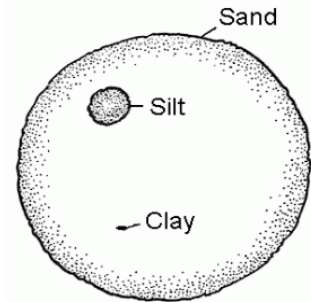


Soil

Rock is the parent material of soil. Exposed rock is broken down by the action of rain and wind (**weather**) into ever smaller particles. When these particles mix with dead plant and animal matter (**organic material**), the mixture becomes soil. Soil also contains millions of organisms that we cannot see (**microorganisms**) and some that we can see like earthworms, grubs, and pill bugs (**macro organisms**). These organisms (**decomposers**) break down the dead plants and animals into new food for the plants.

Soil has 3 types of particles: clay (smallest), silt, and sand (biggest).

The way these particles stick together is called **structure**. All soils in Texas have different amounts of these 3 particles. The best soil for gardening is a combination called **sandy loam**, which is 50 percent **sand**, 25 percent **silt**, and 25 percent **clay**. All types of soil can be changed into sandy loam by adding compost. Healthy planting soil in our garden includes about 50 percent particles of sandy loam, 25 percent water, and 25 percent air/oxygen.



Texture is also important. Soil with lots of composted organic “stuff” in it becomes nice and crumbly. We call this desirable **texture** good **tilth**.

Good soil also has lots of empty spaces in it called pores. Pores are filled with water and/or air. Plant roots and all the soil organisms need water and air to survive. Sandy soil has the most pores. **Sand particles are large** so they don't stick together very well.

Clay particles are smallest so they stick together tightly.

Would water drain well through clay soil? _____

Would plant roots grow longer in sandy soil or clay soil? _____

What would happen if the pores were filled with water? _____

Soil is also sometimes described in layers. The top layer is called **topsoil**. Topsoil is alive with roots of plants, bacteria, fungi (**microorganisms**), and all kinds of creatures (**macro organisms**). The bottom layer is the **rock parent of soil**.

Would plant roots grow better in thin or deep topsoil? _____

What is the parent of soil? _____

List 3 things that can break down the parent of soil. 1. _____

2. _____ **3.** _____

Bonus question: what type of soil would erode more quickly, sand or clay? _____

Why? _____

Healthy Soil

The most basic and important of all gardening topics is the soil in which we place our plants. Sometimes we call it “dirt”, but we should always strive to have “soil” not “dirt” in our gardens. We add nothing to our garden soil but organic products, including lots of compost made by fifth graders. We have changed what was “poor dirt” into healthy soil by adding compost and other organic **fertilizers**.

Healthy soil has lots of food for plants, including the 3 major elements nitrogen (N), phosphorous (P), potassium (K), and trace elements.

To make sure that our plants have all the food that they need to grow, we use **fertilizer** in the garden. A typical fertilizer includes the elements nitrogen (N), phosphorus, (P) and potassium (K). The percentages of nitrogen, phosphorous and potassium are listed in the order N-P-K. For example a reading of 13-13-13 on the outside of the bag means that a fertilizer has 13 parts of nitrogen, 13 parts of phosphorous and 13 parts of potassium, which equal 39 parts. Those 39 parts are 39 parts of the 100 parts of material inside the bag. The 61 parts of 100 that are not nitrogen, phosphorous, or potassium are filler material that is not food for the plants.

Fertilizer that is made from non-living materials is called **inorganic**. Fertilizer made from decomposed once-living material is called **organic**. While nitrogen, phosphorous and potassium may be the most important nutrients for plant health and growth, other elements are also important. Often these other elements are called **trace elements** and can include almost any of the 118 elements on the Periodic Table of Elements. Organic fertilizers are important for healthy plants because they naturally have trace elements in them. Many soils lack the trace elements needed for the food plants we grow.

The phrase, “up, down, and all around” is an easy way to remember how the elements N, P, K are generally used by plants.

N - Nitrogen – **Up** – is important for strong stems and leafy growth. A high number should increase **green growth**.

P - Phosphorus – **Down** – helps to produce lots of flowers and healthy roots. A high number should **increase the number of flowers** and consequently that of fruit and vegetables.

K - Potassium – **All Around** – is essential to the **overall health** of the plant.

Good garden soil includes lots of organic matter, microorganisms and macro organisms.

The problem with many inorganic or chemical fertilizers and pesticides is that they kill off the microorganisms and macro organisms that help to improve the soil. All of these creatures are miniature compost heaps moving through the soil eating organic matter and releasing **humus** which is beneficial and useful for the plant roots. For the microbes to be healthy, we need to add compost or other organic components to the soil. We often do this by mulching around the plants with shredded grass clippings and pine needles, or other kinds of leaves. Healthy soil is a work in progress. No matter how good our soil is, it can always be improved. The important thing to remember is not to take it for granted!

If plant leaves are looking yellow, what element are they lacking? _____

What element, among others, makes plants flower well? _____

If a plant disease is going around, what element would help your plants fight it off? _____

If a bag of fertilizer has a 14-14-14 NPK, what percentage of fertilizer is in it? _____

What is the percentage of “filler” in this bag? _____