Characteristics of Different Soil Types

Sand, Loamy sand, Sandy loam

These are well drained and aerated and workable for most of the year. They are very light to handle and quick to warm up in spring. Unless they have a very high organic matter content they are prone to drying out too quickly, and additional watering will be needed. This extra watering will also help to wash out the plant foods and lime from the soil, so they are likely to be acid (except for some coastal soils). They are often referred to as "hungry" soils and need lots of extra feeding. With careful management however, they can be amongst the most productive soil types.

Medium loam, Sandy clay loam, Silt Loam

These are the "average" soil types. They achieve a good balance between the ability to be very productive and the minimum of attention. The medium loam group is probably the best in this respect.

Clay, Sandy clay, Clay loam, Silty clay loam, Silty clay, Silt

Although these soils are difficult to work and manage, they usually have good supplies of plant foods and lime. The main drawbacks are the high water holding capacity (which means they are late to get going in spring) and the effort required to work them. You will need to catch just the right weather conditions to avoid hard work and damage to the soil structure. The use of heavy machinery (and especially rotavators) should be avoided at all costs, particularly when the soil is wet.

Peat moss or Fen Soils.

Provided they are not too acid and have effective sub drainage, these are probably the best natural soils available. They are rich in plant foods, are easily workable and early. It is possible to convert your existing soil into peat type soil by adding large amounts of organic matter. Some of the keenest exhibition growers do just this. It can be time consuming and costly at first, but once you get there life becomes much easier. You must avoid making your soil too acid though, and careful choice of organic matter is needed.

Chalk soils and Limestone Soils

These are the soils that contain a high proportion of chalk or lime. So much in fact, that it overrides their normal particle size classification. They are often very shallow soils, and severely limit the types of plants that can be grown successfully in them. If you have a soil of this type and are not happy with the range of plants it will allow you to grow, probably the best thing you can do is move to a new area and check the soil out first. If you can't move, the most sensible course of action is to limit yourself to the plants that will grow in chalky soils. Trying to change the soil is usually an uphill struggle and quite expensive. For the incurably intrepid, details are given later in the “Golden Rules for Difficult Soils” section.

Soil Color

Soil color gives information about organic matter in the soil, drainage, biotic activity, and fertility.

Condition	Dark (dark grey, brown to black)	moderately dark (brown to yellow brown)	light (pale brown, yellow)
organic matter	high	medium	low
erosion factor	low	medium	high
aeration	high	medium	low
Available nitrogen	high	medium	low
fertility	high	medium	low

Condition	Subsurface soil color
water-logged soils, poor aeration	dull grey (if in low rainfall soils 0-20 in.)
well drained soils	yellow, red-brown, black (if in forest soils)
somewhat poorly drained soils	mottled grey (if in humid soils)

Soil Conditions-Soil Compaction

Everything in a watershed is connect to everything else-soils, plants, fish and wildlife. The amount of water slowed and stored by the soil and vegetation is a key element in the whole system. Compacted soils don't allow much water penetration. Instead of soaking in, the water runs off, increasing erosion, stripping away vegetation and soils that might otherwise store water. Non-compacted soil absorbs and retains water, releasing it slowly. Plants protect soil from water and wind erosion, and help the soil store water. However, compacted soil has less plant growth, which increases runoff even more.

The rate of infiltration of water into soil gives an indication of the condition of the soil, its ability to control run off and support plant growth. To measure the absorption of water into soil, select two cans of the same size and diameter. Cut the bottoms out of each. Mark the out side of each can two inches from the top. Locate an area with compacted soil near non compacted soil of the same type. Drive the can into the ground until the two inch mark is level with the ground. Placing a board on the top of the can and pounding the board with a hammer will force the can into the ground. Fill the cans with water clear to the top and begin timing the rate of infiltration. Measure the amount of water that has moved downward at the end of each minute for the first ten minutes. Determine the rate of infiltration in inches per minute.

Soil Moisture

The amount if moisture found in soil varies greatly with the type of soil, climate and the amount of humus in that soil. The types of organisms which can survive in an area are largely determined by the amount of water available to them,since this water acts as a means of nutrient transport and is necessary for cell survival.
Soil moisture is determined by drying a sample in an oven or on a hot plate and comparing the weight of the soil before drying to after drying. The weight of the drying container must be known. The soil sample is then added to the container and the container and soil reweighed. Then the sample is heated at approximately 100 C for 24 hours, or until the weight is constant. (Higher temperatures may decompose the organic materials(see soil organic content) to carbon dioxide and water). The container and dry soil is reweighed. The moisture content is reported as percent moisture in the soil sample.

Soil Conditions-Organic Content

The organic content of soil greatly influences the plant, animal and microorganism populations in that soil. Decomposing organic material provides many necessary nutrients to soil inhabitants. Without fresh additions of organic matter from time to time, the soil becomes deficient in some nutrients and soil populations decrease. The amount of organic material can be determined by ignition. Organic material is made of carbon compounds, which when heated to high temperatures are converted to carbon dioxide and water. In the ignition process, a dry solid sample is heated to a high temperature. The organic matter in the soil is given off as gases. This results in a change in weight which allows for calculation of the organic content of the sample. Oven-dry the sample to remove water (see soil moisture). Weigh a crucible and lid, evaporating dish and cover, or other covered container. Place approximately 10 grams of soil sample in the container, cover it and weigh the sample, container and cover. Place the container on a metal stand and heat it with a propane torch. Allow the fumes to escape, but not the soil particles. Heat the sample strongly after most of the gases have escaped; continue heating until there are no visible fumes. Cool the container, lid, and sample. Reweigh and calculate the percent of organic material.

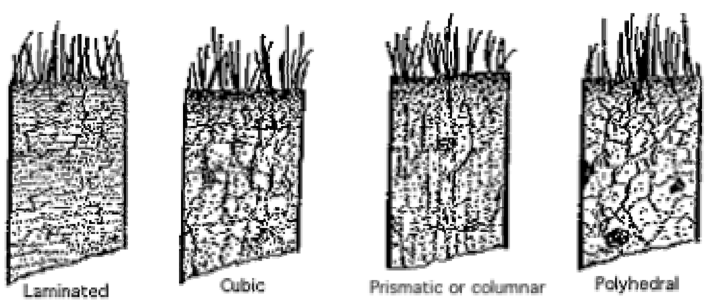
Soil pH

Most plants do well in soil with a pH of 6.5, slightly acid. (see pH Values) . However, rhododendron, camellias, azaleas, blueberries, ferns, spruce, pines, firs, and red cedar prefer soil with a pH of 4.0 to 5.0 . Pines, firs, holly, daphne, spruce oak, birch, willow,rhododendron, alder, and red cedar grow well in soil with a 5.0 to 6.0 pH. Soils with a pH of 6.0 to 7.0 will grow maple, mountain ash, pansy,asters, peaches, carrots, lettuce, pines, firs, alder, and red cedar. Beech, mock orange,asparagus and sagebrush tolerate soils with a pH 7.0 to 8.0. Above 8.5 the soil is too alkaline for

most plants and soil with a pH less than 3.5 is too acid. Each soil layer may have a different pH.
To determine soil pH, a universal indicator or pH paper can be used. Put a small amount of the soil to be tested in a clear or white container. Do not touch the sample. Pour a small amount of universal indicator over the soil. Match the color of the indicator with the pH color chart. If using indicator paper, pour a small amount of water on the soil sample. Touch the indicator paper to the sample and match to color of the paper to the pH color chart.
Soil pH can be raised, making the soil less acidic and more alkaline, by adding lime to the soil.

Soil Profile

The best way to start a study of soil is to find an exposed soil bank or to dig a soil pit and expose the different layers of soil. A cross section of soil is called a soil profile and each layer in the profile is called a horizon. To determine a soil horizon, mark where the soil changes color and general appearance. Many soils have three major layers or horizons, top soil, subsoil and parent material.
Horizon A: Surface-dark gray colored-high organic matter, high biotic activity, abundant roots, commonly leached. Subsurface-moderately dark-many roots, moderate organic matter, commonly leached.
Horizon B: Subsoil-below plow depth-brown or reddish colored-more clay (see soil texture) than surface, fewer roots. Lower Subsoil-more yellowish and less clay-fewer roots than subsoil, less aeration than above.
Horizon C: Parent material-unconsolidated-slightly weathered rocky mass from which soil develops. No biotic activity, few roots. Bedrock-consolidated rock.



Soil Structures

Soil Structure tells us how the soil affects the movement of water, air and root penetration into the soil. The geometric shapes of the soil determine how it is put together. Words such as, blocky, columns, granular, and plate-like describe soil structures.
Determine the structure of each major layer (see Soil Profile). Carefully break apart a shovelful of soil from each layer and match its characteristics with one of the structure word. Use the table to make determinations about the soil conditions of each layer.

TYPE	WATER PENETRATION	DRAINAGE	AERATION

columns	good	good	good
blocky	good	moderate	moderate
granular	good	best	best
plate-like	moderate	moderate	moderate

Soil Temperature

Soil temperature determine the rate of plant growth, and whether a plant will even survive. Temperature will change in each soil layer (see soil profile).
To measure soil temperature, find an area that is not in direct sunlight. Using a centigrade thermometer, measure the air temperature at shoulder height. Hold the thermometer still for about one minute (make sure your fingers are not on the thermometer bulb), read and record the temperature. Next, measure the temperature at the surface of the ground. Let the thermometer lie on the ground and record the temperature after one minute. Below ground temperature readings should be made at several levels, one inch, 2 inches and 6 inches. Pound a dowel into the ground the desired distance, insert the thermometer for one minute. Read the thermometer quickly when it is removed from the soil. The temperature reading will change in air. Take temperature readings at different times throughout the day at the same location.

Soil Temperature	Conditions during growing season
Less than 40 F	no growth, bacteria and fungi are not very active
40 F to 65 F	some growth
65 F to 70 F	fastest growth
70 F to 85 F	some growth
4above 85 F	no growth

Soil Texture

Sand, loam and clay describe the texture of a soil. The type of material that makes up a soil affects the movement of water and air through soil and root penetration into the soil; the looseness and workability of the soil. Each soil layer (see soil profile) could contain soils of different texture.
To determine soil texture, squeeze a moist, but not muddy ball of soil in your hand. Then rub the soil between your fingers. Spit on a small sample of dry soil if water is not available. **Sandy** soil feels gritty and loose. It won't form a ball and falls apart when rubbed between your fingers. **Loam** soil is smooth, slick, partially gritty and sticky and forms a ball that crumbles easily. It is a combination of sand and clay particles. **Clay** soil is smooth, sticky and somewhat plastic feeling. It forms ribbons when pressed between fingers. Clay soil requires more pressure to form a ball than loam soil.
The rate of water percolation is another way to describe the texture of soil. Soils percolate water at different rates. Soil should be watered only as much and as fast as the soil can absorb without runoff. To determine how quickly water moves through your soil, make a water percolating measuring devise from a soup can. First, cut the

top and bottom out of the can. To measure the water absorbed, tape a plastic rule two inches down on the INSIDE of the can. Locate an area where the soil is not compacted (see soil compaction), place a board over the top of the can and pound the can several inches into the ground. Fill the above ground part of the can with water. After an hour, read on the plastic ruler the amount of water that the soil has absorbed. **Sandy** soil absorbs more than two inches of water per hour. It is very porous, with large spaces between soil particles. Little water is retained and the sandy soil dries out quickly. **Loam** soil absorbs from .25 inches to 2 inches per hour. The soil is loose and porous and holds water quite well. **Clay** soil absorbs less than .25 inches of water per hour. Clay soil is dense with few air spaces between particles and holds water so tightly that little water is available for plants.