Sand, silt and clay: the soil minerals

By understanding the properties of soil texture classes, you are better able to develop management strategies best suited to soil limitations.

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■ Sand, silt and clay are the major solid components of soils.

A volume of soil is typically composed of the approximate percentages seen in Fig. 1 on page 26. However, these proportions may change considerably as they are modified by adding organic matter, tilling, irrigating, becoming compacted, and otherwise influenced by man.

The mineral portion of soils is made up of weathered rock called parent material. The chemical nature of parent material varies greatly. The many natural forces, called weathering, that degrade parent material into soil also vary greatly. These two factors account for the vast differences in soils.

Soil with particle sizes less than 2mm is classified into sand, silt and clay. The USDA has established a classification of sizes. However, they are not the same as the American Society of Testing Materials (ASTM) classification system used by civil engineers.

Landscapers and topsoil suppliers often run into difficulty meeting topsoil specifications when the ASTM system is used.

Clay—The smallest particles in soils are called clay. Individual clay-size particles are only visible under an electron microscope.

Because they are so small, they are the source of the more important soil chemical properties. Clays play a major role in the retention and release of plant nutrients. They also help to retain and stabilize the beneficial products of organic matter decomposition called humus.

Because clay particles are so small and have very large surface areas, they retain water very well. They have a high water-holding capacity. However, because of the small size and surface area of clays, most of the water in a clay soil may not be available to plants.

In the landscape, clay soils often display droughty tendencies because of their low water infiltration rate and low available water content.

Clay particles tend to be sticky. In urban soils and sports turfs, this frequently leads to compaction. Compacted soils have a high mineral content per unit volume, while water and air content decreases to a point where turf and ornamental plants my no longer survive.

Silt—Silt particles are intermediate in size. Likewise, their chemical and physical properties fall between those of clay and sand. Silts retain and release fewer plant nutrients into the soil solution than clays. However, silty soils are still considered quite fertile.

Silt particles tend to be spherical in shape. Because of their size and shape, silts readily retain water. But unlike clays, a larger amount of this water is available to plants. Silts have less tendency to be sticky and therefore break up more easily under cultivation.

Compared to clay soils, silts are easier to work into a seedbed and are less likely to form a crusty surface. Aeration cores break down more readily and silty soils are less sticky and easier to work with when wet.

Sand—Sands are the largest of the soil particles. They range in size from 2mm down to 0.05mm and are essentially undecomposed parent material.

Some sands may be rich in certain plant nutrients, but most are very low. Sands generally have a very poor ability to retain nutrients applied as fertilizers. Therefore, sandy soils are best managed by light frequent applications of fertilizers or by using slow-release fertilizers.

Sands typically have poor moisture-holding capacity and drain freely. However, most of the water they hold is readily available to the plant. Sandy soils tend to be droughty and have a high irrigation requirement. An important physical aspect of sands is their ability to resist compaction and retain adequate pore spaces for air and water.

How well a sand maintains the proper balance of air and water depends on the distribution and uniformity of particles within the sand size range. Specifications for golf greens and rootzone mixes call for a very specific sizing of sands and a high degree of uniformity within these size ranges.

When clayey or silty soils are amended with sand, the physical properties of the soil typically worsen. However, if the correct size, uniformity and quantity of sand is used, soil physical properties can be improved. A physical analysis of the soil and sand is required, and proper mix volumes must be determined.

Texture—Soils are typically made up of sand-, silt- and clay-sized particles in an almost infinite mix. Soil scientists have developed a classification of soils that assigns 12 texture classes, according to

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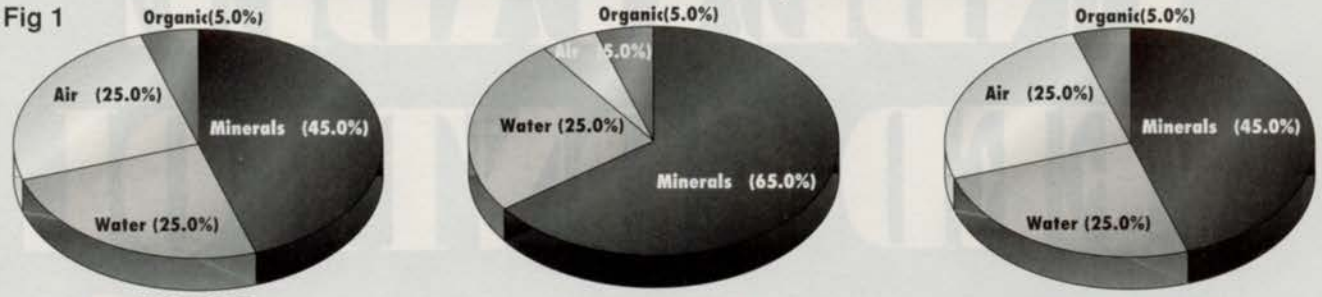
SOIL COMPOSITION (BY VOLUME)

Fig 1



their range of particle sizes. The textural triangle is used in conjunction with a laboratory analysis to determine the texture class of a soil.

Many landscapers are often faced with specifications for soil textures that may not be present on site, and may be difficult to find. In constructing new landscapes, layering problems often occur when soils two or more texture classes away from each other are placed on top of another.

Because of the unique chemical and physical properties that sand, silt and clay impart to a soil, it is important to recognize the advantages and disadvantages of the soil texture classes and their impact on managing turf and ornamentals.

Structure—Organic matter also plays an important role in soil structure. Sands have no structure and occur as discreet particles. As the content of silt, clay and organic matter increases, individual particles stick together to form larger particles.

Silty and clayey soils will have improved drainage and aeration when well structured. Unfortunately, when silty and clayey soils are pulverized or compacted, they lose their structure. The addition of organic matter to silty or clayey soil will help form a well-structured soil over time.

Sand, silt and clay form the mineral particles that compose the major volume of a soil. An understanding of soil texture is important to avoid problems during construction of turf and landscape areas.

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