

Coping with Clayey Soils

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Soil is a major consideration when choosing plants. Soil consists of inorganic (weathered rock and minerals) and organic (decomposed plant and animal matter) materials and has taken thousands of years to form. Soil characteristics of most concern to gardeners are texture, structure, drainage, pH, organic matter content, and available nutrients. This article focuses on texture and structural elements of the soil.

Soil texture is the ratio of inorganic particles present in the soil, with sand being the largest particle, followed by silt, and clay (microscopic particles). Soils high in clay tend to pose significant problems in urban areas when not managed effectively, including poor drainage and poor aeration.

One way to assess soil texture is simply by feeling the soil between your fingers. Dig up a shovel-full of soil when it's slightly moist (not wet or bone dry) and hold it in your hand. If the soil feels gritty and crumbles easily it probably has a relatively high sand content. If it remains in large clumps that do not break apart easily, and if it feels sticky when moistened, then clay is more prevalent. Silty soils feel more like flour. Loamy soils are a mix of these three particle sizes and tend to crumble relatively easily.

Soils high in clay typically will not be as well drained as other soils because they have tinier pore spaces (voids) between particles, which slows the movement of water and air in the soil. This condition is worsened if the soil is compacted, which reduces these pore spaces even more. In this situation, during quick, short-term rainfalls, most water will run off with little infiltration or percolation through the soil. On the other hand, during long episodes of rain, the soil could become saturated and remain wet for a long time. Root growth is limited in these situations due to lack of oxygen, and root uptake of water and nutrients also is greatly reduced. Roots may also grow more closely to the soil surface to receive more oxygen, making the plant more susceptible to drought stress. These roots tend to be shorter with fewer root hairs and therefore have a reduced capacity for water and nutrient absorption. Drought conditions can be exacerbated in clayey soils because the microscopic clay particles hold water more tightly, making it difficult for plant roots to extract the water.

Soil drainage can be tested by digging a one foot deep and two feet wide hole (again when the soil is slightly moist) and filling it with water. Observe how long it takes for the water to drain out of the hole. If it takes less than an hour for the water to drain, the soil has excellent drainage. If the water remains after twelve hours, the soil is probably poorly drained, usually because the soil has been disturbed and compacted on urban sites.

What can be done about clay soil? Keep in mind that soil takes thousands of years to form, and it is unreasonable to expect to transform it in a single year. The best option for gardening in clay soils is to select plants that are adapted to this environment. Look for species native to Illinois, particularly those native to prairies and poorly drained bottomlands. Many of these plants can withstand drought as well as flooding. When planting trees and shrubs, it is imperative that they are not planted too deeply. In areas of very poor drainage it may be beneficial to plant trees slightly higher than the surrounding landscape. For further information on tree planting depth, refer to the article by Dr. Gary Watson: "Avoiding Excessive Soil Over the Root Systems of Trees: A Best Management Practice" at

<http://www.mortonarboretumphc.org/feature%20articles/Plant%20Care%20and%20Management/Avoiding%20Excessive%20Soil%20Over%20the%20Root%20Systems%20of%20Trees%20a%200B..pdf>.

Amending clay soil can be effective but be careful not to work the soil when it is wet as this can result in compaction. Adding organic matter is the best way to improve clay soils: it improves aeration and water infiltration, reduces compaction, and improves soil structure. Partially decomposed or composted organic matter, including manure, leaf mold, mushroom compost, or homemade compost can be added to the soil annually and will also add nutrients to the soil. Fresh organic matter, such as sawdust, fresh manure, and grass clippings also will help to aerate the soil but can bind up available nitrogen. In this case, it may be necessary to add nitrogen fertilizer when using fresh organic material.

Mulching plants is always a priority because it produces many of the same benefits as incorporated organic matter. After the soil is amended and plants are installed, two to three inches of organic mulch should be added to the top of the soil. Planting in raised beds is another option for poor drainage, but is only feasible for small shrubs or herbaceous plants.

Adding sand to clay soil is not recommended because it can create a concrete-like substance. Sand is only effective when equal parts of existing soil and sand are mixed on a very large scale (which may not be feasible). Though clay can be a challenge for gardeners it provides the soil with important characteristics. Clay soil is generally rich in essential plant nutrients and holds water well. A nice variety of plants will grow quite well in clay soil and with time heavy clay areas can be improved. Below is a list of plants that are known to perform well in clay soil. Consider this list as a starting point and take time to discover the many different plant species that can flourish in our Illinois soils.

For more information about soil conditions and ameliorations, see the Arboretum's leaflet "Soil Considerations for Growing Trees and Shrubs."

Plants for Clayey Soils

Trees

Acer x freemanii – Freeman's maple
Betula nigra – River birch
Carpinus caroliniana – American hornbeam
Crataegus spp. - Hawthorns
Ginkgo biloba – Ginkgo
Gymnocladus dioicus – Kentucky coffeetree
Picea spp. – Spruces
Quercus bicolor – Swamp white oak
Quercus macrocarpa – Burr oak
Ulmus parvifolia – Lacebark elm

Shrubs

Aronia melanocarpa – Black chokeberry
Cephalanthus occidentalis – Buttonbush
Cornus alba – Siberian dogwood
Cornus stolonifera – Red-osier dogwood
Forsythia spp. – Forsythias
Physocarpus opulifolius – Common ninebark
Potentilla fruticosa – Potentilla
Rosa rugosa – Rugosa rose
Syringa spp. – Lilacs
Viburnum spp. – Viburnums (most species)

Perennials

Aconitum spp. – Monkshood
Amorpha fruticosa – False indigo
Aquilegia chrysantha – Golden columbine
Buddleja davidii – Butterfly bush

Coreopsis verticillata – Tickseed

Dalea purpureum – Purple prairie clover

Helianthus maximilliana – Maximilian's sunflower

Hemerocallis spp. – Daylilies

Heuchera spp. – Coral bells

Leucanthemum maximum – Shasta daisy