Understanding Your Soil

Neil Diboll, Consulting Ecologist

With more than 40 years of experience in the research and establishment of native plant communities, Neil is an internationally recognized pioneer in the use of North American plants in contemporary landscapes. He is a regular keynote speaker on topics such as establishing prairie meadows, designing with native plants, and the benefits of converting resource-intensive landscapes into self-sustaining ecological sanctuaries.

A major factor in determining how well your plants and seeds will grow is their compatibility with your soil. Each plant species has a range of soil types in which it will flourish. It is important to choose your seeds and transplants to match your soil conditions. Some species are able to grow in a wide range of soil types, while others may only grow in specific soils. For instance, Yellow Coneflower, Black Eyed Susan, Bergamot, Ox Eye Sunflower, and Smooth Aster, along with the tall prairie grasses Big Bluestem, Indiangrass, and Switchgrass grow in a wide range of soils and moisture conditions. Alternatively, Lupine and Rough Blazingstar only thrive in dry, well-drained sandy soils.

Soil Types

Soils can be divided into three basic classifications based upon their mineral (non-organic) content: sands, loams, and clays. There is variation within these basic groups, but these categories will suffice for the purpose of describing where a plant will or will not grow.

SANDY SOILS

Sandy Soils, referred to as "light" soils, contain large-sized soil particles that are loose and easy to work. They allow water to drain readily, and are typically low in nutrients. Sandy soils are often more acidic than more fertile loams and clays, especially those derived from limestone or dolomite parent material (bedrock). Sands also have lower buffering capacity and are readily acidified by years of accumulation of evergreen tree needles.

CLAY SOILS

Clay soils are commonly known as "heavy" soils. Consisting of very small, tightly-packed soil particles, clays tend to be dense and hard to work. They should never be worked or cultivated when wet, as this can compact the soil and create significant soil structure problems that can restrict the absorption and movement of air and water down to the roots for many years. Clay soils are generally naturally rich in nutrients, have a high water-holding capacity, and can be very fertile and productive.

LOAMY SOILS

Loamy soils are intermediate between sands and clays. Composed of a balance of sand, silt, and clay particles, they combine fertility and moisture-holding capacity with good drainage. Easier to work than clays, and more consolidated than sands, loamy soils are an ideal garden soil, and most native plants will grow well in them. Exceptions include species that require very dry, excessively well-drained sandy or rocky soils, and will not tolerate even temporarily moist conditions.

Determining Your Soil Type and Soil Textural Classification

There are three ways to determine your soil type, or "Textural Classification":

1. Send a soil sample to a lab for a soil textural analysis – most state University Extension Services offer this option, or you can send your samples to a private soil testing lab.
2. Do a "Field and Feel Test"
3. Conduct your own Home Soil Textural Analysis test

FIELD AND FEEL TEST

The "Feel Test" involves taking just enough damp soil to rub between the thumb and fingers. Rub it back and forth many times and feel it very carefully. You may find it helpful to close your eyes and focus on your tactile senses without any visual distraction. A predominantly sandy soil will feel gritty, and will not stick together. A loamy soil will stick together, but not tenaciously like a clay, and will usually not feel "rough" and gritty like a sand. Sandy loam will stick together and feel moderately gritty due to a sand content between 50% and 70%. As the soil dries in your fingers, rub it into a

dust and feel it carefully. A loamy soil will have a component that feels like flower. This is silt, a soil particle that is intermediate in size between sand and clay. Clay mail also have a floury feeling due to a silt component. Clays can be distinguished from loams by taking a ball of damp soil and rubbing it between your hands. A clay will create "ribbons" that stick together as the soil is rolled. Loamy soils will not form ribbons, and break apart when rubbed between two hands.

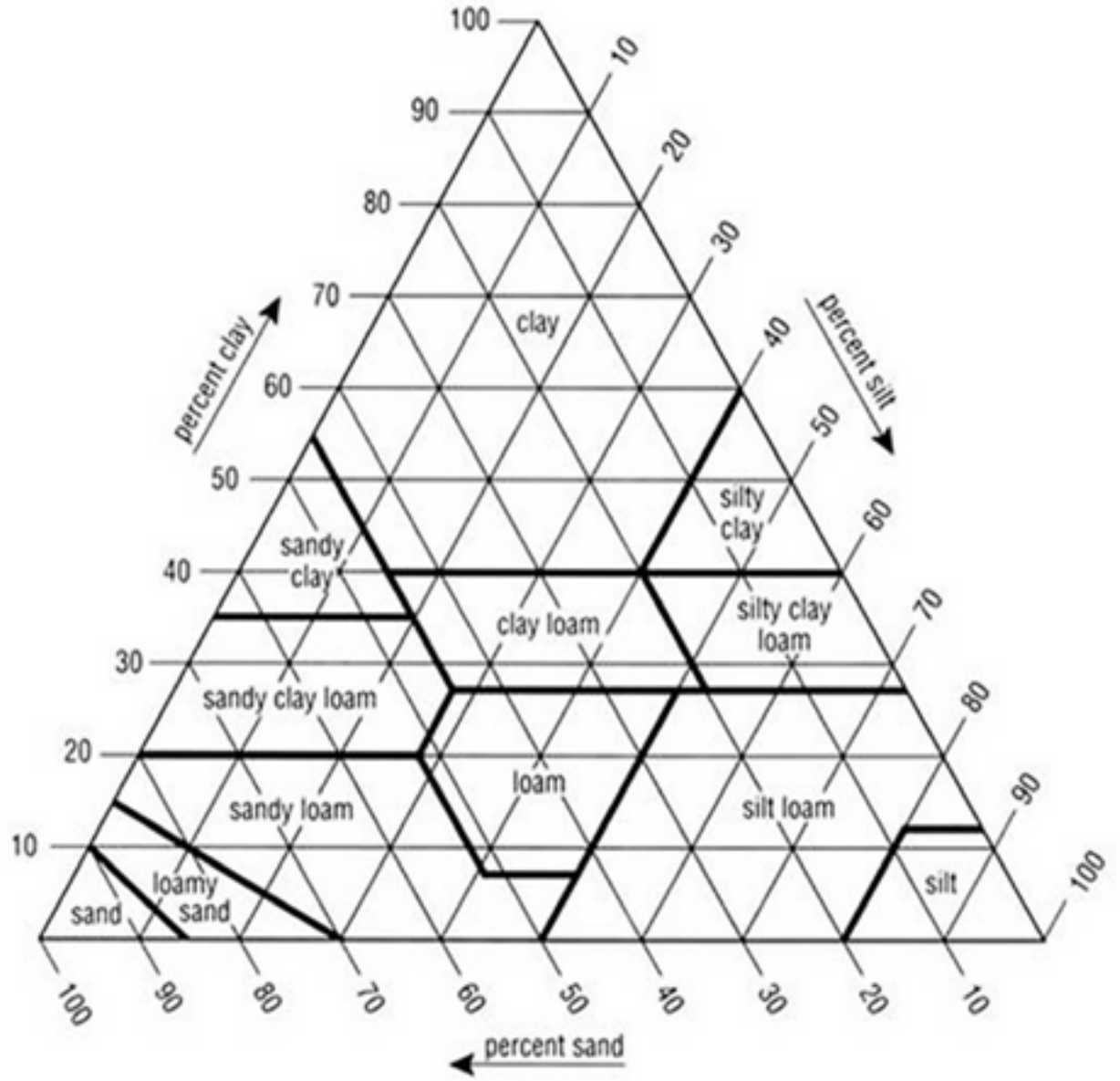
Another method is to dig into your soil when it is dry. A sandy soil will seldom, if ever, exhibit clods. Any clods that do form will crumble easily. Loamy soil will form clods that can be sliced cleanly and easily with sharp spade. Clay soils tend to form hard, persistent clods when dry. Rather than slicing through them easily, the spade will get stuck or shatter the clod into many hard little blocks of soil.

HOME SOIL TEXTURAL ANALYSIS TEST

You can determine your soil's textural classification by taking numerous representative soil samples from across the field, mixing them together, and then selecting sufficient soil to fill a glass quart canning jar about 50-60% full. Add water to fill the jar to about one inch from the top, and shake it vigorously for a minute or so to mix the soil thoroughly into the water. Set the jar down and immediately begin timing the settling process.

After 40 seconds, mark the settled soil line with a black sharpie pen. This is the sand portion. After two hours, mark the next settled soil line. This is the silt portion. Allow a day for all the soil to settle. This can be accelerated by putting the jar in the fridge. Once all the soil has settled, measure the total depth of soil from top to bottom in the jar, and then the length of each soil portion that was marked with the sharpie. You can then calculate the relative percentage of each soil component: sand, silt, and clay by dividing each portion's length by the total length of the soil column in the jar. For instance, if the total length of the soil in the jar is six inches, and the sand component is three inches, sand accounts for 50% of the soil content. If the length of the silt portion is 1.5 inches and the clay portion is 1.5 inches, they each account for 25% of the soil content, for a total of 100% when added to the sand percentage.

Consult the Textural Triangle on the following page to determine your soil textural classification.



Soil Management

Line up the percentages for each of the sand, silt, and clay portions on the triangle, and their point of intersection within the triangle will yield the textural classification of your soil.

SOIL PH – ACIDITY AND ALKALINITY

Soil pH can typically range from 4.0 (extremely acid) up to 8.5 (extre4mely alkaline), with 7.0 being neutral. If your soil has a pH of 5.5 or less, consider amending it with lime (Calcium carbonate) or dolomitic lime, which contains both Calcium and Magnesium carbonate. Wood ashes can also be added to bring up the pH up to a more optimal pH level of 6.5. Most native prairie and woodland wildflowers, grasses, and sedges will do well in a pH between 6.0 and 7.0. A few species are "Calciphiles" that require a pH between 7.0 and 8.0. such as Shootingstar, Purple and White Prairie Clover, Rattlesnake Master, Columbine, and Wild Ginger. Most woodland wildflower will grow in acid soils between 5.5 and 7.0. A few, such as Foamflower, require an acid soil, and do not do well in alkaline soils with a pH above 6.8.

Alkaline soils, especially those with a high "buffer pH," are difficult to bring down to a lower pH because of the ability of Calcium carbonate to absorb acidic soil amendments such as sulfur. It is best to accept the fact that your soil is alkaline, and select the plants that are known to thrive under those conditions, rather than going to great lengths to adjust the pH downward.

IMPROVING YOUR SOIL WITH ORGANIC MATTER

To improve a problem sandy or clay soil, there is no better method than to add copious quantities of organic matter. Well-rotted compost, leaves, and composted manure are excellent. Do not use sawdust, wood chips, or similar materials, as these require many years to break down and rob the soil of Nitrogen. Avoid un-composted manure. It typically contains large numbers of weed seeds, and fresh manure can be "hot" with high Nitrogen levels that can burn plants' roots. Peat moss is excellent for amending clay soils, but tends to "disappear" into sandy soils. It is also expensive compared to most other forms or organic matter, and is typically produce by mining Canadian wetlands. Peat moss is usually acidic, and can sometimes cause a drop in soil pH in sandy soils with low buffering capacities.

Organic matter holds more water and nutrients than any other soil component. It helps to break up heavy clay soils, improving water intake and air exchange to plant roots. Organic matter firms up light sandy soils, making them richer and less drought-prone. In each case, it modifies a soil that it behaves more like a loam. He benefits of adding organic matter include increased seedling survival, better root development, and faster plant growth.

TIPS FOR WORKING WITH CLAY SOILS

Clay soils with low levels of organic matter can be difficult to work. The fine soil particles pack tightly together and are easily compacted, impeding drainage and air exchange. In the heat of summer, clay soils harden and prevent downward root growth. Clay soils warm slowly in spring, delaying when one can begin working in the garden, especially if the soil is low in organic matter that facilitates air movement into the lower soil. Adding organic matter helps to "open up" clay soils by improving their porosity, or "breathability."

Soil Moisture

Soil moisture is a critical factor in determining what species will thrive in your soil.

DRY SOILS

Dry soils include sandy, gravelly, and rocky soils that drain readily and never have standing water, even after a hard rain.

MEDIUM SOILS

Medium (mesic) soils include well-drained loams, clays, and sandy loams. These soils may have standing water for short periods after a hard rain, but will drain readily with a day or so.

MOIST SOILS

Moist soils typically occur in low-lying areas, and have moisture available in the subsoil throughout the growing season. They may experience extended periods of standing water for days or even

weeks during the dormant season, as well as for a few days after significant rainfall events during the growing season.

Conclusion

The primary factors that determine a soil's growing conditions include soil texture, organic matter content, pH, and moisture-status. Once you have determined these parameters, you can select plants that are adapted to your specific growing conditions. A few dollars spent on a soil test could save hundreds of dollars in poorly-performing or dead plants. Understanding your soil is the first, and most important step to successful gardening and ecological restoration.

Know Your Soil, & Reap the Benefits of Your Toil!