Improving Your Garden Soil

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What can you do to improve your garden soil? The question is as old as gardening itself.

From the time man first tilled the soil and planted seeds he has tried to improve the performance of the plants he grew. Most basic has been improvement of the soil.

Early settlers on the eastern shores of North America received a good lesson when planting seeds and growing plants. Native Americans showed them that by placing a fish in a planting hole the plants would grow faster and yield better. At the time neither knew what the fish in the hole did, but it worked. They didn't know the fish carcass provided nitrogen, phosphorus, potassium, calcium, sulfur, and other essential plant nutrients, often deficient in many rain-soaked soils.

Our knowledge of soils and plant nutrition and growth has come a long way during the past four centuries since the fish-in-the-hole lesson.

The Soil That Is Ours

The soils we inherit from earlier generations are often drastically altered from the original. Farming operations before our homes were built began the soil's change. Native prairies and woodlands were converted to agriculture. Or, if originally a forest, logging and other

operations had its impact on the soil. Both took their toll, either in loss of soil structure and perhaps plant nutrients, or compaction, or both.

Years later home construction became the second phase in the change. Heavy equipment compaction layered the soil below the surface. Existing soil was dug to make room for basements or crawl spaces. This soil was then spread over the existing, putting layer upon layer. Fill soil was, and still is, often brought in, creating further layering of the soil.

As a result few of us have the privilege of gardening in native, virgin soil. The soil we have has commonly lost much of its structure and ease of working. Some of us are working subsoil, underlaid with good, fertile topsoil. Often the soil's fertility state has been changed, resulting in nutrient imbalances, with increased acidity or alkalinity.

A redeeming feature is that there is much you can do to improve the soil you have. A number of practices can improve the soil and make it highly productive for you.

Soil Layering and Compacted Layers

First, let's look at a compacted, layered soil that many of us have. If at all practical, thoroughly mix the layers of soil by spading or rototilling. If your lot or acreage is sufficiently large, a deep-running plow or backhoe will effectively break up compacted layers and mix the soil layers. Farmers use "subsoilers" to break through compacted soil layers, an alternative for larger lots.

The downside of equipment is that it also can create compacted soil layers. Rototillers "beat" the soil, thus compacting it, at the lowest extension of the tines. However the compaction from rototilling is a "lesser evil" than the needed breaking of a more severely compacted layer and mixing of layers. Keep in mind that a rototiller never tills as deeply as it appears. Therefore the larger the rototiller the more effective it will be.

Plows and most other equipment also tend to create compacted layers at the lowest depth of their penetration. Again, the newly created compacted layer is seldom as severe as the one for which the equipment is used.

Soil, when in distinct layers, frequently has another problem. Layering of soil, especially when done by man, often creates drainage problems. Downward water movement in soil is commonly impeded when soil is artificially put into layers. Thus the importance of mixing the layers of soil.

Soil Drainage

Poor drainage greatly restricts plant growth and what plants you can grow. Test the drainage of your soil by digging one or more holes to a depth of 2 to 3 feet. Fill the hole(s) with water. The water should disappear within 30 minutes or an hour. If it does not disappear within 24 hours, only shallow rooted plants will survive.

Don't confuse slope with good drainage. A sloping soil may be poorly drained internally. Use the test above to

know for sure if your sloping soil has adequate drainage.

The poor drainage of many garden soils is due to layering of soils and to compacted soil layers. Corrective measures discussed previously can correct many such problems.

Soil drainage can be improved by tiling, or sometimes with "French drains," ditches a foot or more deep filled with sand and/or small gravel with an outlet for the water to drain away. If you have a soil drainage problem contact your local university Extension office, Natural Resources and Conservation Service (USDA) office, or business specializing in drainage problems for information and assistance.

Adding Soil

Bringing in soil is sometimes a solution to problems of low lying areas or providing a productive soil over one that is filled with rocks, debris, or other materials. It may help improve a soil of extremely poor structure or heavy texture, high in clay and poorly drained. To avoid creating layers, thoroughly mix the added soil with the top six inches or more of the soil below.

Be sure to acquire good quality soil. Much available "topsoil" is the topsoil from the bottom of a hole, and is of poor quality. In most cases the best soil to acquire is that which is most like what you now have, even with its faults, to avoid layering. Topsoil from nearby excavations for home, business, industrial, or other construction is a good place to start your search for a

source of good soil. In any case, try to acquire soil that is from the surface 12 inches, more or less.

Enhancing Your Existing Soil

"My garden soil is a poor, clay soil," is an all too common complaint. Often poor soil structure is mistaken for high clay content. The soil is hard, crusty, and difficult to work. Some soils are "loose" and seem to have no body or structure. The solution is to add a good soil amendment to improve the soil structure.

First, let's allay some misconceptions about clay soils. Few, if any, soils are pure clay. Some are high in clay, and nearly every soil, except pure sand, has some clay in it. Clay is a very important soil component. It imparts many desirable qualities to the soil. Without clay a soil is likely to be less fertile, even infertile, and added nutrients are readily leached from the soil. Clay does this because of its cation, pronounced cat-ion, exchange capacity, an electrical process not unlike your car battery with its plus (+) and minus (-) charges, that attracts plant nutrients and holds them from leaching out of the soil.

In the minds of some the solution to a soil high in clay is to add sand. This, too, is not without problems. Add the right amount of sand and you will have made great concrete. The right amount of sand has to be determined for each site. There is no one easy answer to this. So, in most cases, sand is not the answer.

How can you know if you have a clay soil? When the soil is rather wet, form a ball an inch or two in diameter.

If the ball is rather sticky it may be due to clay. Then, with the ball between your thumb and forefinger, make a continuous thin ribbon about 1/8 inch thick. If the ribbon sticks together its full length the soil clay content is relatively high. If the ribbon breaks or crumbles after it is an inch, more or less, long you probably do not have a clay soil. It is likely a desirable silt loam, loam, or clay loam soil. If it crumbles immediately as it leaves your fingers, your soil is still lower in clay and higher in silt and sand content. This procedure may take a little practice before it works well for you.

Benefits of Organic Matter

Raw organic matter offers limited benefits. It's in its decomposition that the benefits occur. Many products are formed within the soil that function to improve soil structure, aeration, water-holding capacity, and enhance plant nutrition. Partially decomposed organic matter is often called "humus", the merits of which are known by many people.

Adding organic matter to your soil is an excellent solution to poor structure, and a much better alternative than sand. It also behaves much like the clay particles as described previously, enhancing soil fertility, without the structural problems of some heavy clay soils. Organic matter has an exchange capacity that often exceeds that of a clay soil. One of greatest values in mixing organic materials into a soil is its effect on soil structure. Organic material itself, or in its decomposition, binds soil particles together to form larger particles. This is especially important in heavier soils that are higher in clay. This

improves the soil's drainage ability and air holding capacity, both important for plant growth. The organic material itself, and the resulting effects of its decomposition on soil, improves the soil's tilth.

Organic material has great water holding capacity. So, while it improves drainage it also holds more water, keeping the soil moist longer for plant growth.

In decomposition of organic matter the soil micro-organism – bacteria, molds, actinomycetes, etc. – population increases manyfold, for it is they who are responsible for the decomposition. This releases nutrients from the organic matter, also benefiting plants, and provides the many other benefits from using organic matter.

Plants themselves contribute organic matter to the soil. With a constant flux of new roots being formed and old roots dying organic matter is added. However, it's a relatively low amount with continual tilling of the soil for planting and replanting. Continuous grass growth over many years may add 5% to the soil's original organic matter content, which is a significant amount.

Organic matter will benefit most soils, regardless of texture or structure.

Sources of Organic Materials

Almost every community offers its unique types of organic materials. In forested areas sawdust and barkdust are readily available. Grain straw is available in

most communities. Sugar cane, coconut, rice, nut, and other agricultural industries produce useful by-products. Legume hays are not only good sources of organic matter, but also of plant nutrients. Leaf mold, the partially decayed leaves from your trees or from the forest floor, has long been a favorite organic material. Garden waste and other composts have become much more available in recent years and, when well prepared, are free of weed seeds and plant pathogens. Of course, each of us can have readily made compost made from our lawn clippings, tree leaves, garden and kitchen wastes, and other materials.

Peat, aka peat moss, has been a standard organic source. It is still the same good product as in the past, but may occasionally contain weed seeds or pathogens, depending upon method of harvesting. Peat decomposes more slowly than most other organic sources and thus may give its effects comparably longer.

Animal manures have for years been among the best organic sources. While providing organic matter they can also be a good source of plant nutrients. Partially decomposed “old manure” is a good source of organic matter but inferior to resh manure in plant nutrients. The fear of “burning” with fresh manure is easily offset by applying less of the better product. Unfortunately manure may contain numerous weed seeds, including those of noxious weeds.

When purchasing manure inspect carefully for unwanted problems. One, garden centipedes (symphyllans), introduced into a soil can cause tremendous damage for

years to come by feeding on plant roots. It's best to avoid manure stored for any length of time on the ground. Older manures are more likely to come with these problems.

Organic materials high in lignin, such as wood products, straw, grass hay, and hulls, can deplete soil nitrogen during their decomposition. Supplemented nitrogen, supplied by a fertilizer relatively high in nitrogen, will correct the deficiency. Wood products take up to four years of decomposition for the "softwoods" – pine, fir, spruce, etc. – before a nitrogen balance is reached in the soil. Hardwoods – oak, maple, beech, etc. – take about half this amount of time for decomposition. This is usually not a problem with peat since it naturally contains some nitrogen, or with composts, leaf mold, manures, and other such sources.

Dealing With Sandy Soils

A truly sandy soil will feel gritty when rubbed between the fingers. Most sandy soils have at least a little clay and silt in them, but insufficient amounts of clay, especially, to hold nutrients and water. Structure of sandy soils may be either loose or, with an insufficient or "wrong" amount of smaller particles and organic matter, hard and crusty and impenetrable to water when dry. They are inherently low in plant nutrients and good tilth.

Sandy soils can be much improved by "diluting" with good soil and/or organic matter. The amendment(s) should be thoroughly worked into the top six or more inches of the soil, as deeply as possible.

It is wrong to assume that a sandy soil is well drained. If the sand is underlaid by a compacted layer drainage can be a serious problem.

Generally, in sandy soils fertilizer should be applied in lesser amounts but more frequently to avoid loss by leaching and contaminating ground water. This is more important with water-soluble inorganic than organic fertilizers.

Soil Testing

Testing your soil is a good way to determine the pH (acidity or alkalinity), need for pH correction, and nutrient content of your soil, with suggestions. A good soil sample for testing is a composite of samples taken throughout your garden, then thorougly mixed together when sufficiently dry by pouring back and forth from one clean bucket to another. Follow all instructions of the testing laboratory to which you will submit your soil sample. One thing you will not learn about your soil from the test is the soil's texture, that is, if it is a clay, clay loam, loam, etc. A few labs, however, can make a texture test for you for an additional fee.

Generally Speaking

Organic matter will do as much, or more, to improve a given soil than most any other practice. Worked deeply into the soil its effects can often be seen for years to follow. The only real "downside" in using organic matter is the nitrogen imbalance that high lignin materials can

present, and the potential for insect, weed, and disease problems of some organic sources. Seldom do the problems outweigh the benefits.

Keep in mind that working a soil when it is excessively wet or when excessively dry should be avoided. When too wet the soil structure is broken down, causing puddling or "plastic remolding." When too dry the soil is ground or pulverized into dust, also causing a breakdown of structure. In between lies a rather narrow range of wetness for optimal cultivation of the soil.

Improving your soil – make it enjoyable and watch your garden grow!