J&L Garden Center

The All Season Gift and Garden Center

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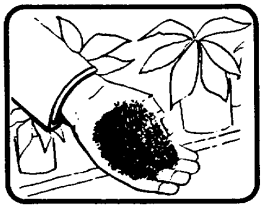
www.JLGardenCenter.com

Garden Soil

'Dig a $100.00 hole for your $10.00 plant'. It's a ***dirty*** job, but every gardener needs to do it if they want the best results they can get. Soil preparation is the most important part of gardening. Without the proper preparation, gardening can be a chore for you, and your plants will just not respond and grow the way you want them to.

Remember, ***Garden Soil is not Dirt.*** Dirt is the stuff you wash out of your clothes after working in the yard. Good Garden Soil is a complex mixture of minerals, air, water, organic matter, microbes, and other soil organisms. Soil is full of life and needs our attention. Without good soil we cannot grow plants as easily, or produce food as abundantly, as we can with good soil. With good garden soil, gardening will be more fun. The soil will be easier to plant in, cultivate, and it will be easier to grow your plants. The better the soil, the better your gardening results will be.

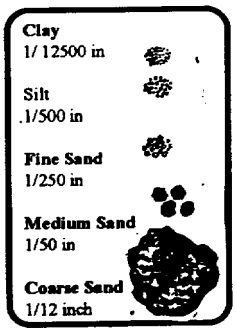
What's in Good Garden Soil?



Pick up a handful of soil from your garden and look at it. About half of that handful will be solid materials; soil particles, minerals, living organisms, and dead organic matter. Even though the soil is mostly solid materials, you won't be able to see many of the individual soil particles, unless the soil is sandy or it has coarse organic matter. Each individual soil particle is too small to see, so you actually see aggregates of soil particles, not individual soil particles.

The other half of your handful consists of the pores (or spaces) between the solid particles. You won't be able to see these pores because they are very small, but they are in the soil if it is good garden soil. Pores are an important component of good garden soil because they form the space available for water and air. The roots also grow in these pores, roots cannot grow in or through the individual soil particles. Ideally, these pores alternate between holding water and storing air. Not many of the soil organisms (microbes, insects, worms, etc.) can live very long in soil without air. Except for water plants and bog plants, most plants cannot live in soil void of air. A water logged soil quickly loses its soil structure and texture, and becomes unusable for many plants. Some anaerobic organisms can live in water logged soil but these organisms are not beneficial to good gardening. You may have smelled the effects of these anaerobic organisms when you dug into some wet soil and were inundated with a strong ammonia smell or were overcome by a pungent rotten odor.

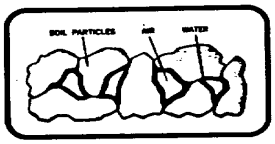
Soil Texture



Mineral particles vary in size from coarse (sand) to fine (silt) to extremely fine (clay). Pore spaces also vary in size from large to small. There are tiny "micropores" where water is stored and there are large "macropores" where air is stored and where roots grow.

When you hear people talking **soil texture,** they're talking about the size of the soil's particles. **Soil texture** is referring to whether the soil is mostly sand, silt, or clay. Fortunately, most soils contain a mixture of all these particles. The relative proportions of these particles determines the soil texture.

Sandy Soil (coarse texture). You can readily see the larger particles making up sandy soil. They are large and so are the pores between them. Water and air move easily in this type of soil, through the large pores. Anyone who's gardened in a predominantly sandy soil knows how well water drains through sand. The more sand in the soil, the drier the soil is. That is because water passes right through the large pores without any physical forces holding it in place; the physical forces that hold water in the soil are called cohesion and adhesion. Nutrients can also pass through the soil so quickly that they do not have time to attach to any of the soil particles. The plants may not be able to absorb added nutrients quick enough to use them before these nutrients wash away with the water. Sandy soil does have some good points. Sandy soil is

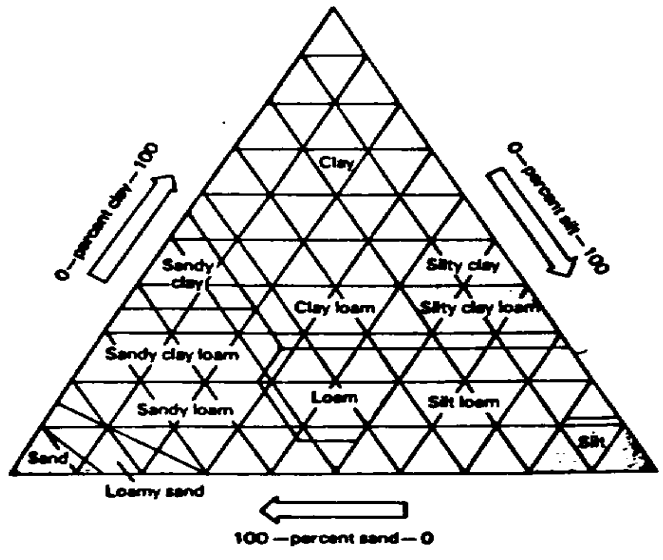


easy to cultivate; it drains well so it loses a lot of weight quickly (hence its nickname ***'light soil'***); and plants growing in sandy soil do not usually die from *'Root Rot'*.

Silt Soil (small texture). Silt particles are small, about the size of talcum powder. Silt particles, however, are still many times larger than clay particles. Silt has many small pores, which hold water fairly well (it has more adhesion and cohesion properties than sand). Silt particles, however, don't hold nutrients very well; the nutrients pass through the soil quickly. Silt is found in a lot of different soils, both sand and clay. When mixed with sand, silt helps improve the soil's ability to hold water. When mixed with clay it helps to create larger pores, allowing water to drain away faster.

Clay Soil (fine texture). While sandy soils have lots of big pores and soil particles, clay soils have millions of small ones. Clay particles are so tiny that many can only be seen with a microscope. The spaces between the particles are very tiny also. Some clay soils absorb water so slowly that a lot of water often runs off its surface before it can soak into the soil. Once water gets into the soil, the clay particles hang on to it and do not let the water drain away very quickly. Consequently, this water holding characteristic of clay soil does not allow oxygen to move in and out of the soil very well. Compared to sand, clay is a much better soil for plant growth because it holds more water. However, the water may be so tightly "attached" to the clay particles that plant roots can't use it. Plants may wilt and die in clay soil before they would wilt and die in sandy soil, even though both soils may contain adequate amounts of water. This water holding characteristic can be considered either a problem or it can be a good feature, depending how it is managed.

Clay has a very good redeeming feature. Clay particles are electrically charged so they can grab and hold onto nutrients passing through the soil. Many clay soil particles have a negative charge which attracts and holds positively charged nutrients such as Potassium, Sodium, Ammonia, Calcium, Magnesium, and Hydrogen (also part of the water molecule). Unfortunately, sometimes these nutrients are attached to the clay particles so strongly that the plants are unable to absorb them and use them. Organic materials in the soil will also grab and hold onto nutrients moving through the soil just like the clay particles do, but organic matter releases these nutrients more readily. Sand and silt particles are not as electrically charged as clay so they just allow nutrients to pass through the soil with the water. Clay is usually a highly fertile soil, if you can cultivate it and use it. For this reason it is good to have some clay particles in your soil; you just don't want your soil to be mostly clay.



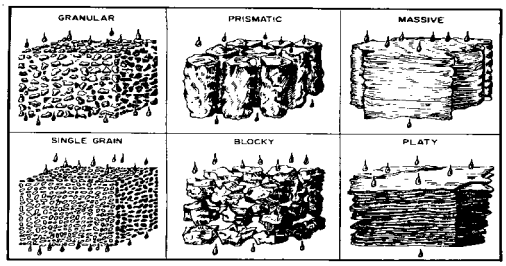
This texture triangle shows the limitless combinations of soil textures. A clay soil contains about 60% clay, 20% sand, and 20% silt. Loam contains 40% sand, 40% silt, and 20% clay.

Clay has earned its nickname of a ***'heavy soil'***. When wet, clay is heavy and it sticks to whatever it touches. Clay soils are hard to hoe, difficult to cultivate, and they are especially hard to clean up.

You will rarely find pure sand, silt, or clay; which is a good thing or you would be constantly fighting the worst qualities of each type of soil. Instead, there are many different types of soils, which have varying combinations of the three soil particle sizes. When a soil does not show the dominant physical properties of any one of these three groups it is called **Loam.** A soil that is mostly clay is called **Clay Loam.** A soil that is mostly sand is **Sandy Loam.** A soil that has a lot of both clay and silt is called **Silty-Clay Loam.** You can help change your soil's texture by adding large amounts of the soil particle size your soil is lacking. The key words are **large amounts.** Adding just a little sand to a clay soil is only good for making a soil that clumps into bricks, while adding a lot of sand will help loosen the soil up.

Soil Structure

Soil structure describes the shape individual soil particles take when they clump (aggregate) together. Aggregates can be granular, prismatic, massive, single grain, flat, blocky, or platy (layered). Aggregates can congregate into even larger groups known as dirt clods.



If a soil has good soil structure, it has good **tilth.** Tilth means that the soil can be cultivated to a condition that is ideal for plant growth. Good garden soil will have good **porosity,** which means the soil contains plenty of air spaces

for healthy plant growth, and it can hold plenty of water for plants to use. Soil porosity can be easily changed by the amount of organic matter added to the soil, by the frequency of cultivation, and by the timing when cultivation actually occurs. Cultivating wet soil damages the soil structure by decreasing the amount of air in the soil and by making soil aggregates stick together in big clumps; dirt clods. Cultivating a damp or dry soil helps improve soil texture by adding air spaces in the soil and by breaking up dirt clods. Soil structure has a tremendous influence on how easy it is for plants to grow. Good garden soil will also be **friable** which means the soil will crumble into smaller aggregates without much effort. Plant roots can easily penetrate and grow in friable soils.

What type of Soil do you have?

One of the best combinations of soil particles is loam soil. An ideal loam soil contains two parts each of sand and silt and one part of clay. This mix of particles in loamy soil gives it a medium texture. This texture lets it hold water well, yet it has plenty of pores for oxygen to sustain plants and microbes. The clay particles in this soil makes the loam soil fertile.

Sand
Sandy Loam
Sandy Clay
Loam
Silt Loam
Slit
Silty Clay Loam
Clay Loam
Clay
Or Anything In
Between.

To see what type of soil you have, collect a soil sample from several areas in your yard. Mix these soil samples together and measure one cup of the soil, making sure the soil is completely pulverized. Fill a quart jar two-thirds full of water. Add one teaspoon of dishwasher detergent and one cup of your soil sample. Shake the jar vigorously for ten to fifteen minutes then set the jar where it can be left undisturbed for several days.

Sand particles are the heaviest and will settle in a few minutes. Mark the jar at the soil level after two or three minutes. Silt particles will settle next. Mark the jar at the soil level after two or three hours. Clay particles are very tiny and require a few days to settle. Mark the soil level as soon as the water is clear, sometimes two or three days.

Measure each layer of soil and of the entire soil level. To determine the percentage of each type of soil, divide the thickness of each layer by the thickness of the entire soil level, and then multiply by 100. When you determine the percentage of each soil type check the texture triangle, on the previous page, to determine which type of soil you have.

Organic Matter

Most native soils contain about three to five percent organic matter. The main source of natural organic materials is from the things that live and die in the soil; roots, bacteria, fungi, insects and other soil dwelling critters. A good garden soil should contain between twenty-five to fifty percent organic matter.

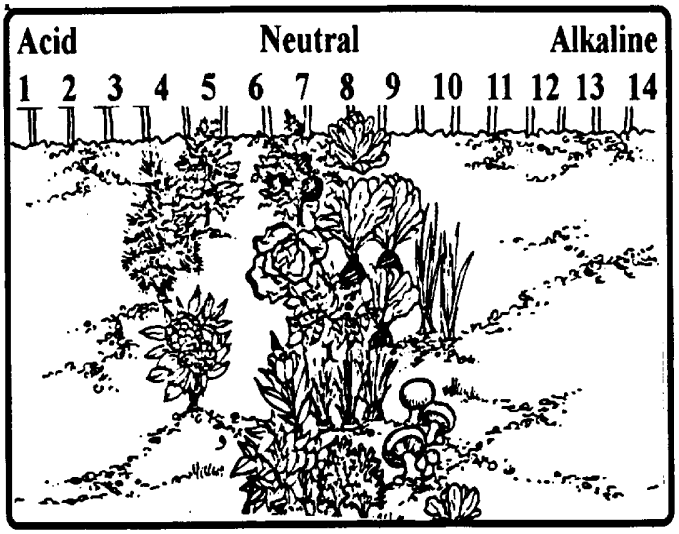
Think of organic matter as a 'miracle cure' for soil: it keeps the soil healthy. Organic matter supplies many nutrients that plants need and it helps hold other added nutrients in the soil long enough for plants to absorb them. Organic matter also provides a gluey substance called 'humic acid', which helps binds individual soil particles together into larger groups called aggregates. When soil particles begin to form aggregates, soil structure starts to develop and plants have a much easier time growing. We have a handout that lists all the different types of organic materials we have available. This handout lists the different ingredients in each product. We have turkey manure, chicken manure, horse manure, steer manure, bat guano, bark compost, sawdust, peatmoss and peatsedge, just to name a few. Please ask for a copy so you can decide which type of organic matter is best for your garden.

Soil pH.

Another component of soil are chemicals. Chemical components are minerals and ions that are part of many plant nutrients. They also help to determine the **soil pH.** Naturally, these minerals come from both the organic matter growing in the soil and from the rock source that originally made the soil.

Soil pH is a measurement of the hydrogen ions in soil. If there are lots of hydrogen ions in the soil, it is an acid soil. If there are just a few, the soil is alkaline. The soil pH is measured on a scale from 1 to 14. Soils with a pH from 1 to 6.5 are acidic; Vinegar has a pH of 4. Soils with a pH from 7.5 to 14 are alkaline; oven cleaner has a pH of 9. Soils with a pH near 7 are neutral. The pH scale is logarithmic, which means a soil that has a pH of 6.4 is ten times more acidic than a soil that is 6.5, and one hundred times more acidic than a soil that has a pH of 6.6.

Plants grow best when the soil pH is near 7 (neutral) because more nutrients in the soil are available for them to use. There are exceptions to this rule. Some plants, such as rhododendrons and azaleas prefer an acid soil. Other plants, such as baby's breath, lilacs, peonies, alfalfa, many



native grasses, and sweet peas are well adapted to grow in alkaline soils. When the soil pH is between 6.5 to 7.5 most of the nutrients in the soil are water soluble. Plants can absorb and use these soluble nutrients easier than having to extract them from the soil in a non-soluble form. At a higher or lower pH, many nutrients combine into insoluble compounds and plants can't use them as easily.

The best way to determine the pH of your soil is to take a soil test. The USU Extension Service has a soil test packet that gives instructions for taking a soil sample and instructions how to send the sample to the lab for testing. After you receive your soil's test results you can change the soil pH as needed. To make your soil's pH more acidic you can add sulphur, iron, or aluminum sulphate. All organic matter, especially peatmoss, will also help to acidify your soil. To make the soil more alkaline add calcium (lime) to the soil.

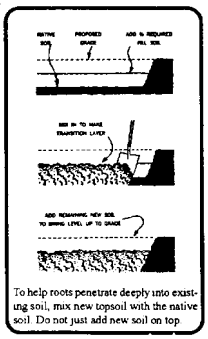
Most soils in Utah are on the alkaline side of the pH scale. Very few soils in this area are acidic so we seldom recommend using lime in home gardens. If extra calcium is needed in your soil, but you do not want to raise the soil pH, add gypsum rather than lime. Gypsum adds calcium and sulphur to the soil without raising the pH very much.

The soil test will also indicate if your soil is lacking in other chemical nutrients. Your soil test may suggest that you need to add iron, potassium, calcium, zinc, or some of the other 21 major and minor minerals plants need for proper growth. Soil tests do not usually test for nitrogen because nitrogen is always lacking in the soil and nitrogen is the major nutrient in most bags of fertilizer. Regulating the amount of nitrogen you add to your soil each week, month or year, is a skill that takes years of practise; a lot of trial and error.

If you don't need a precise pH test you can try a simple home test. Gather a handful of dry garden soil, free of sticks, pebbles and leaves. With a large plastic spoon, scoop up a tablespoon of the soil. Add several drops of vinegar. If the soil fizzes, your soil is alkaline and it has a pH over 7.5. If it doesn't fizz, take a fresh plastic spoon, scoop up another spoonful of garden soil and add water until it is very moist. Add a pinch of baking soda. If it fizzes then you have an acid soil, a soil pH of less than 5. In this area your soil is probably alkaline, not acidic. You can also preform this same home test a little more precisely by using litmus paper to indicate how alkaline or how acidic the soil is. We have an inexpensive soil test kit available that can give you general pH levels, not precise levels like the USU soil tests will give.

Fixing your soil.

Adding new topsoil is an excellent way to improve your soil immediately. It will improve both sandy and clay soils, if you buy good topsoil. Make sure you buy a good topsoil or you may just get more soil problems to deal with. Good topsoil immediately corrects the existing soil conditions. You can add either a sandy or a sandy-loam topsoil to existing clay soils or sandy soils. Try to only add a clay-loam topsoil to an existing sandy soil, not to an existing clay soil.


To help roots penetrate deeply into existing soil, mix new topsoil with the native soil. Do not just add new soil on top.

Do not just put a few inches of good soil over existing (native) soil and leave it. Roots cannot penetrate through extreme changes in soil texture or structure; they need a transition zone. Thoroughly mix the new topsoil with the existing soil as deeply as possible.

No matter what problem your soil has, **adding organic matter is usually the best way to fix your soil.** Organic matter helps sandy soils hold more water and it helps grab onto nutrients; making the soil more fertile. Organic matter helps create larger air spaces in clay soils, allowing water to drain away more quickly. Organic matter also helps make clay soils become less sticky. Organic matter supplies many nutrients, helps build better soil structure, creates a home for many soil dwelling critters (worms) and adds the micro-organisms and insects necessary to build a healthy soil.

Well-composted materials are the best types of organic matter to add for improving soil - because they're already well-decomposed. Composted materials are stable and do not require extra nutrients from the soil. Composted materials also supply significant amounts of ***'Humic Acid'***; a gluey material that helps to bond soil particles together into aggregates.

Even if you do not have well-composted materials available be sure to add what ever organic matter you have. It is better to add fresh organic matter than to just let the soil remain in the same condition. Adding uncomposted or partially decomposed organic matter may add a few unwanted weed seeds to your gardens. Also, the bacteria decomposing the organic matter will compete for nitrogen in the soil. Organic matter needs bacteria to decompose it and turn it into compost. This bacteria needs nitrogen to grow and multiply. The fresher the organic matter the more bacteria is needed and the more nitrogen is necessary to decompose it. If you do not add any extra nitrogen to the soil, when you add fresh organic matter, the bacteria will take the nitrogen from the soil so the plants will not get as much nitrogen as they need to grow properly. Plants may grow slower than normal or they may be stunted if they run out of nitrogen.

How much Compost?

There are no hard and fast rules as to how much compost you should apply. However, the more organic mat-

ter you add the better your soil will eventually become. It is usually impossible to add too much organic matter to soil; especially if you add well-composted materials. Be sure to add organic matter every year, not just every *once-in-a-while*. The only limitations to adding compost to your soil is how deep your tiller can dig, how much compost you can afford, or how strong your back is. Be sure to thoroughly mix the compost into the top four to eight inches of soil. It may take several years of adding compost for the compost to actually change the soil structure, so don't give up. But, if you mix enough organic matter into the soil right at the start, just its physical presence can be an immediate improvement to the soil. You will see improvements in your garden every year as the organic matter level in you garden soil increases.

It takes tons, not just bags, of compost to correct soil problems.

Most gardeners do not realize how much organic matter it takes to improve soil: ***It takes tons, not just a few bags, of compost to improve your garden soil.*** To figure how many tons (actually how many cubic yards) of compost you need to add to your garden, multiply the length of your garden by its width. Then multiply by how many inches (convert this number into feet by dividing by 12) of compost you want to add. Divide this number by 27 (there are 27 cubic feet in a cubic yard) to find out how many cubic yards of compost you need.

Garden Example:

You want to add 4 inches of compost to a 20 foot by 20 foot garden area.

20 x 20= 400 square feet
400 x (4÷12) = 133 cubic feet
133 ÷ 27 = 4.9 cubic yards

A cubic yard weighs between 800 and 2,000 pounds, depending on its wetness and its ingredients. A standard 1/2 ton pickup truck can usually carry up to 1,500 pounds. You may need to make two to five trips to haul this much compost. ***As you can see, you need tons of compost to improve your soil, not just a few bags.***

When to Add Compost

The best time to add organic matter is in the fall, when you roto till your garden for winter. Leaves, garden plants, trimmings, and sawdust are all good sources of organic matter readily available in the fall. Manure, Nutri Mulch, Bumper Crop, and Soil Pep are also excellent sources of organic matter available anytime of the year.

The second best time to add organic matter is in the spring; when you first roto till your garden for the year. Be careful not to add any fresh or uncomposted materials in the spring; you may cause a few unwanted problems during the summer growing season. Add well rotted organic matter and thoroughly mix it into the soil. Packaged steer manure, peatmoss, Nutri Mulch, Bumper Crop, or Soil Pep are excellent products available to mix into your soil any time during the spring and summer.

Garden Tip: Add 1 cup of ammonia sulphate for every six inches of fresh leaves, or fresh organic matter, you add to your garden in the fall - for every 100 square feet (10' by 10'). Fresh leaves, branches, and sawdust require extra nitrogen for the bacteria to decompose them. Roto till the organic materials into the soil in the fall, rather than letting them stay on the surface through the winter.

Inorganic Amendments

Inorganic materials such as Utelite, perlite or vermiculite, will help to lighten clay soils and help to improve sandy soils. Utelite, perlite and vermiculite do not decompose so they will remain active in the soil for many years. These products' particles create larger pore spaces in clay soils, allowing water to drain away more quickly. Vermiculite is made by heating mica (hydrated laminar) at very high temperatures. It improves water retention and helps regulate fertilizer release in the soil. Perlite is made by heating sand (siliceous volcanic rock) at very high temperatures. Perlite has excellent water retention and nutrient holding qualities that make it an ideal, long-term soil amendment. Perlite is often used as an additive in potting soil. Utelite is mined near Coalville, Utah. It is extremely helpful in breaking up hard or compacted clay soils. It improves water retention and helps oxygen penetration in the soil. Utelite is expanded shale, an inorganic product that does not decompose and will remain in the soil for many years. Mix plenty of Utelite in the soil before you plant, you will see an immediate improvement in your gardens. Use Utelite, perelite, or vermiculite in addition to organic mulches - not in place of them.

Sand is also often used to help lighten clay soils. Be careful if you add sand to clay soils because 'just-a- little' sand could actually make the clay soil worse. If you don't add enough sand to your clay soil and roto-till it into the soil thoroughly, you could end up with soil as hard as concrete instead of a lighter soil. If you plan to add sand to your soil there are a couple of guidelines to follow. 1) If your tiller can dig six inches deep, you need to add three to four inches of sand to the soil and mix it thoroughly. 2) Be sure to use coarse sand, not fine sand. Sand that has been screened to eliminate the fine particles is best to use. Fine

sand may fill the pores, making the clay soil hard, instead of helping to lighten the soil.

Humic Acid

Humic acid is derived from humates, a mined product that is an excellent soil additive. Humates have many other uses in other industries as well. In gardening, humates help form Humic Acid. Humic acid helps improve the soil structure by *gluing* individual soil particles together into aggregates-creating air space in the soil. Humic acid helps plants absorb nutrients more efficiently by *chelating* these nutrients into usable forms. Humic acid also helps improve plants' disease resistance and it stimulates soil microbial activities.

Humates are highly compressed, prehistoric organic materials derived from both plant and animal sources. They were composted for thousands of years and were compressed by layers and layers of rock and soil covering them. Through volcanic eruptions, humates were brought to the surface, available for mining them to use. Because of the high carbon content available in humates, they provide many beneficial activities that help plants grow more profusely.

Add humates to your garden soil every year or two. Humic acid does not provide a *quick fix* to the soil but you will notice an immediate improvement, both to the soil structure and in the plant's growth. Continued use of this product will produce amazing results each year. Use humic acid to supplement the compost and chemical fertilizers you apply, not to replace them. Humic acid is also very beneficial as a lawn fertilizer supplement. It helps prevent and eliminate thatch build up as well as helping the lawn overcome many diseases.

Chemical Amendments

Gypsum helps to chemically change soils by adding calcium and sulphur to the soil. Adding calcium and sulphur helps to release other nutrients that are already in the soil. By chemically changing soils, plants are able to absorb and use the many nutrients, released from the clay particles, that were not previously available for plants to use. The nutrients were already in the soil, they were just not available for the plants to absorb.

Gypsum helps all types of soils, acid or alkaline, become more pH neutral. Because of the combination of both sulphur and calcium in gypsum, it will not acidify the soil to a level below 7 nor will it raise the pH of a soil above 7.3. In our area, adding gypsum helps to lower the pH of a highly alkaline soil closer to neutral. Farmers often buy gypsum by the truckload to lower the soil pH of heavy clay soils, especially those soils high in sodium (alkali soils). They apply tons of gypsum per acre. Gypsum will also help to raise the pH of an acid soil to near neutral, which is often needed in other areas of the country.

Gypsum may also help improve the soil structure and other soil conditions over a long period of time. Gypsum helps the soil to develop aggregates by helping to get rid of the sodium ions in the soil. Sodium ions force soil particles to repel each other, preventing them from forming into aggregates. Sodium also makes the soil feel slippery and sticky. Adding gypsum makes the sodium ions soluble. Then, as you water, the sodium ions will leach away. By eliminating sodium from the soil the natural soil particles can join together more readily, helping to gradually improve the soil structure.

Gypsum will help chemically change your soil quickly. However, gypsum has a very slow and a very limited effect on physically changing the soil structure or conditions in your gardens.

If All Else Fails

If your soil is just not workable, or if you are tired of trying to improve it, you might try **Raised Bed Gardening.** Raised bed gardening is fairly simple to accomplish and it solves many of the gardening headaches caused by poor soil. Build a framework (or make a mound) that will hold at least eight inches of fresh soil - twelve to eighteen inches of soil is even better. Fill the framework with a mixture of 50% Loam Soil, 40% Organic Matter and 10% Inorganic Materials. This new garden soil will have its own qualities and drawbacks. It may take a year or two for you to learn how your garden soil responds to water, fertilizer, and other gardening nuances. Each year you should have a fun and rewarding gardening experience.

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