The Dirt on Healthy Soil

An in-depth guide to determining soil type and amending accordingly

At a Glance

Healthy Soil Needs:

- Organic material
- Balance of nutrients
- Life (plants, worms, etc.)
- Little to no compaction, room for water and air flow, root growth

Types of Soil:

There are tests you can perform at home to determine your soil type

- *Sandy-drains quickly*
- *Clay-retains liquid*

Amendments:

- No-till cultivation
- Biological organisms
- Fertilizer
- Compost
- Mulch
- Manure
- Cover Crops, or "Green Manure"

What makes soil healthy?

Healthy soils consist of:

- Organic material (or OM): Presence can be detected by smell, texture, and color.
- Nutrients: Nitrogen, phosphorus, potassium, and micronutrients.
- Life: Plants, insects, fungi, nematodes, and invisible bacteria; life needs water and oxygen
- Little or no compaction: Pores leave room for oxygen and water. This also leaves room for the development of larger root mass (another contributor to healthy soil).

The best way to achieve a healthy balance in your soil is by amending it. For sand, use peat moss, top soil, and compost to provide organic content and moisture retention. For clay and other types that don't drain as well, amend with compost or peat moss to increase organic content and improve drainage.

Testing for Acidity and Nutrient Content

Most plants grow best in soils with a pH of 5-6.5. In Colorado, a lot of our soil tends toward the alkaline side, between 7.0 and 7.8 or above. There are inexpensive tests you can use at home. A test that we carry in our garden supply department can been done at Colorado State University, and gives you not only a detailed analysis, but also suggestions for how to improve your soil. The recommended solutions for acidic soil here in Colorado are adding organic matter, organic mulches, and light, frequent irrigation.

Improving your soil

- No-till cultivation: Avoid unnecessary roto-tilling, as it destroys mycorrhizae (beneficial fungi) and soil structure. Instead, use a broadfork, only digging where you plant. Mulch for weed control- try straw, grass clippings, and shredded bark.
- Avoid compaction: Stay off your garden beds as much as possible. Use no-till cultivation; utilize wise designing and plant in a way that mimics nature.
- Mulch: Avoid fabric and plastic as they starve soil of air flow/oxygen. Plastic fabrics block light, nutrients, water, and oxygen. Stick with organic material. For an inexpensive alternative, try newspaper or cardboard covered with straw, grass clippings, leaves, or bark.

Encouraging biological organisms

Earthworms, along with a host of other organisms, decompose organic matter in soil. As earthworms digest, the form taken by the nutrients they consume is one that is more readily available for absorption by nearby plants. These "castings", or nutrients digested by earthworms, carry significantly more nutrients usable by plants than the surrounding soil. In addition to nutrients, the burrows of earthworms create passages for air, water, and roots. In so doing, they also increase moisture retention of soils.

Encourage earthworms by providing a food source in the form of organic material. This can be achieved by mulching grass clippings, putting down layers of organic mulch in beds, amending soil with compost, and turning under green manure. Avoid chemical fertilizers, herbicides, and, of course, pesticides.

Beneficial Fungi (Mycorrhizae)

Mycorrhizal fungi are fungi that have a symbiotic relationship with the root systems of living plants, from garden vegetables to trees in old growth forests. These fungi support the plant's own ability to utilize water and nutrients in soil, encouraging healthy, vigorous growth. They also enhance the plants' ability to tolerate environmental stress (drought, dry winter weather, etc.), and reduce transplant shock. Plants with these beneficial fungi require less fertilizer, and may have fewer soil-borne diseases.

Fertilizers

Another benefit of knowing your soil type, pH, and nutrient content is that it will allow you to choose the fertilizers that will be most beneficial to your garden. Fertilizers have an N-P-K rating (nitrogen, phosphorus, potassium) that will supplement your own soil's composition. Nitrogen is good for green leaves, phosphorus for roots and flowers, and potassium for overall health and vigor. Organic fertilizers are very beneficial; look for kelp, manure, and bone meal (high in nitrogen and phosphorus).

Compost

Compost is a very effective way of adding organic material to your garden, and is also helpful in reducing kitchen waste. It attracts earthworms and other beneficial organisms and provides nutrients to vegetables while improving soil. When composting, try to balance "green" (wet, high nitrogen) with "brown" (dry, high carbon; i.e. dead leaves). "Green" compost items are coffee grounds, chopped leaves and grass clippings, eggshells, fruit waste, grains, manure, seaweed, vegetable scraps, weeds, etc. "Brown" compost items are corncobs, cornstalks, hay, nutshells, paper (avoid colored paper), sawdust, straw, etc.

Items you should NOT compost: Meat scraps, or trash containing a lot of fat, diseased plants, pet droppings, plants sprayed with synthetic chemicals (pesticides, herbicides, etc.)

Once you cannot distinguish any of the raw materials in your compost, you'll know it's ready for use.

Manure

Composted manure will be lower in nitrogen than raw manure, but will have higher levels of phosphorus and potassium. When adding amendments to soil, keep in mind that they decompose at different rates. Grass clippings and manure decompose the quickest, breaking down in a few weeks. Composts can take up to six months. Wood chips, bark, and peat can take years to break down.

The fresher the manure, the more nitrogen it has. Use caution if the manure is from horses or cows, as these animals don't digest seeds in their food nearly as well as other grazers like goats, rabbits, alpacas, and sheep. If you can access them, these are better manures to use.

Cover Crop or "Green Manure"

Green manure is a crop that is grown and mixed in with soil to increase the content of organic matter. Crops that fall in this category include buckwheat, clover, soybeans, and winter rye. Some of the advantages of green manure are increasing nutrient content for plants, and also preventing erosion. Ground that is covered rarely erodes.

For More Information*

Fertilizers, Amendments, & Soil Management, CSU Extension

Soil Testing, CSU Extension

Composting Yard Waste

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