Amending Your Soil Using Environmentally Sustainable Practices

By Harriet Custer
August 12, 2016

Amendments can improve the soil and help plant growth

With the continuing focus in Northwest Washington on protecting our environment, small gardeners are increasingly interested in organic and sustainable gardening practices. This all begins with the quality and content of our soil, as well as methods for building a living, healthy soil. Most soils in the PNW are slightly acidic, which is one of the keys to soil health; in addition, soils must be well-drained and rich in nutrients. Few soils, however, contain all of these requirements, so appropriate amendments are required. These amendments serve to improve the structure of the soil and increase the organic content so that the soil is more able to hold moisture and make nutrients available to plant roots.

Gardeners have found a variety of soil amendments that are helpful in building healthy soil. Most recently, bioenergy technology has introduced soil amendments such as biochar as alternatives and/or additions to more traditional amendments. In order to understand the benefits of bioenergy-derived soil amendments, it's important for gardeners to understand the basics of soil structure (http://www.planetnatural.com/product-category/organic-gardening/soil-care/soil-amendments/).

Soil is biologically active—composed of weathered rock fragments and organic matter, full of living microorganisms. The texture of the soil depends on whether it is sandy (with greater permeability and drainage), silty, or clay (with less permeability but greater moisture retention). All soils can benefit from additions of organic matter, which serves to build and stabilize the structure of soil no matter what its texture, improving both aeration and permeability.

When organic matter decomposes, it forms "humus, which acts as a natural glue to bind and strengthen soil aggregates," according to Craig Cogger, a soil scientist at Washington State University Extension. Soil teems with life, including, most obviously, those critters that we can see, such as earthworms and insects. In addition, however, soil contains thousands of microorganisms that are busy breaking down soil components into nutrients that plants can access. In "The Hidden World under Our Feet," Jim Robbins contends, "A single teaspoon of soil may contain billions of microbes," as well as thousands of species of "protozoa, nematodes, and mites." As these microorganisms break down the soil components, they release energy, nutrients and carbon dioxide, and create soil organic matter. Their activity depends on the temperature of the soil, as well as moisture and organic content.

Here at the Discovery Garden, master gardeners prepare compost material to be used later. This process takes several steps. *Photo by Nancy Crowell / WSU Skagit County Master Gardeners.*

Soil supplies 13 essential nutrients to plants, the most important of which are familiar to most gardeners: nitrogen, phosphorus and potassium. In addition, secondary and tertiary nutrients such as sulphur, calcium and copper, are required for plant health. Nitrogen is the nutrient most needed by plants and its management is critical to a productive vegetable or flower garden. As the soil warms up in the spring, Cogger explains that soil microbes "begin breaking down organic matter, releasing some of the nitrogen as ammonium," and nitrates, which are then available to plants. (Nutrients are available to plants only after they are converted to soluble forms, which occurs through the weathering of minerals and the biological decomposition of soil-borne organic matter.)

While some amounts of nitrogen and other nutrients are available to plants in the soil, the addition of these elements in the form of fertilizer is usually necessary, particularly for vegetable gardens, which tend to use up nutrients more quickly than, for example, perennial flower beds. In order to determine what nutrients are required to create and/or maintain a healthy soil over time, soil testing is recommended. Organic fertilizers—such as manure, cottonseed meal and other animal and fish by-products—are slower to release nutrients than processed fertilizers, but generally contain material that adds organic matter to the soil.

Soil amendments are materials that improve the condition of the soil and aid plant growth. The organic amendments most commonly used in home gardens are compost and mulch. Experts agree that compost is the best way to ensure good, healthy soil. Many gardeners make their own

compost, either through vermiculture (worm bins) or composting household garbage and yard waste. However, all organic matter eventually decomposes, so the garden may sink; this is particularly apparent in raised beds and containers.

In addition to compost, mulch is an excellent way to not only help the soil retain moisture, but to improve the structure of the soil. Examples of organic mulch include bark chips, leaves, straw and pine needles. According to Linda Chalker-Scott, Associate Professor at Washington State University, the use of organic mulches is "one of the least invasive and most cost-effective ways" to improve soil structure.

A master gardener chops greens to be added to a compost mixture. *Photo by Nancy Crowell / WSU Skagit County Extension.*

Relatively new to home gardeners are bioenergy-derived organic soil amendments products such as biochar, which is very promising as an effective and environmentally supportive soil amendment. Bioenergy is renewable energy made available from materials derived from biological sources (http://www.biochar-international.org). Biochar is charcoal produced from plant matter and stored in the soil as a means of removing carbon dioxide from the atmosphere. Believed to be used by Pre-Columbian Amazonians to enhance soil productivity, biochar is a high-carbon fine-grained residue produced today through a complex thermo-chemical process.

Biochar has the capacity to (1) fight global warming, (2) produce a soil enhancer that retains carbon and increases the fertility of soil, (3) reduce agricultural waste and (4) produce clean, sustainable energy. One of biochar's functions as a soil "enhancer" is that it slowly releases a base supply of nitrogen to the soil.

According to the International Biochar Initiative, it can reduce the leaching of nitrogen into groundwater, moderate soil acidity, reduce soil emissions of greenhouse gases, improve water quality and increase the retention of water and beneficial soil microbes. While other soil amendments need to be applied at certain rates every year, biochar remains in the soil and single applications can provide benefits over many years.

RESOURCES:

- Chalker-Scott, L. (2008). *The informed gardener.* Seattle: University of Washington Press.
- Cogger, C. (2005). *Home gardener's guide to soils and fertilizers.* Pullman WA: Washington State University EB1971E.

- Cogger, C. (2010). Soil science. In *WSU Extension Master Garddener Volunteer Training Manual* (pp. 3.1-3.22). Pullman, WA: Washington State University
- http://www.biochar-international.org
- Martin, D. L. (2014). *Rodale's basic organic gardening: A beginners guide to starting a heslthy garden.* New York: Rodale Press.
- McGuire, A. (2016, June 26). *WSU Center for Sustainable Agriculture and Natural Resources.* Retrieved from Washington State University: http://csanr.wsu.edu/organic-and-synthetic-nitrogen/
- (http://www.planetnatural.com/product-category/organic-gardening/soil-care/soil-amendments/).
- Robbins, J. (2013, May 11). The hidden world under our feet. *The New York Times*.