Soil Quality

Q: Why Is Healthy Soil Important for Your Garden?

A: Healthy soil is essential for plants to grow in your garden. When a property has been used for industrial or commercial activities, the soil is often nutrient deficient, highly compacted and potentially contaminated. These soils can be improved and made healthy again so that your garden plants can grow and thrive. Healthy soil holds water and contains beneficial organisms, plant nutrients, and organic matter.

Soil Nutrients

Soil nutrients are vital for healthy soil and must be available for plants to grow. Soil tests will help you determine the existing nutrients available in your soil and indicate which nutrients and nutrient amounts need to be added. Mineral nutrients such as nitrogen, phosphorus, potassium (NPK), and calcium can occur naturally in the soil, but often need to be applied to maintain a healthy balance. Soil nutrients may be added in various forms, including: fertilizer and lime (available in most gardening stores) and organic matter such as grass clippings, leaves, and compost.

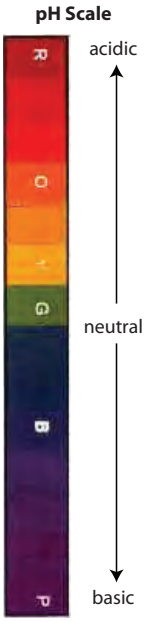
Physical Properties of Soil

The physical properties of soil determine how well nutrients are available to plants. Soil contains a combination of sand, rock, silt, clay, air, and organic matter, which affects its ability to hold nutrients and water.

You can improve the physical quality of your soil by leveling and loosening the soil and adding organic matter such as compost and manure. These additions can increase the amount of water that sandy soils can absorb or hold and can improve the drainage of clay soils.

Soil pH

Soil pH affects the amounts and types of nutrients available to plants through their roots. The pH scale goes from 0 to 14; a pH of 7 is neutral. A lower number means a more acidic soil, while a higher number means a more basic or alkaline soil. Certain nutrients are less available to plants in soils where the pH is too low or too high. When a soil's pH is near neutral, nutrients are more readily available to plants, and microbial populations in the soil increase. A soil test will tell you the pH of your soil. Based on this information, you will be able to determine whether soil amendments (soil additions) are needed to change the pH of your soil to meet your gardening needs. You can raise the pH of soil by adding lime or wood ash. You can lower the pH of soil to make it more acidic by using fertilizers containing ammonium-nitrate or specialty fertilizers for "acid-loving" plants that contain ammonium sulfate or sulfur-coated urea.



For more information on amendments that can be used to improve soil quality, see Techniques for Addressing Soil Contamination in the Resources section in this fact sheet, page 11.

Contaminants

A soil contaminant is an element or chemical present in the soil at a level that could possibly pose health risks. In a few areas of the country, element levels may be naturally high. In many cases, human activities have increased the soil levels of many elements and chemicals and also spread them out more widely. Lead, cadmium, arsenic, zinc, and polycyclic aromatic hydrocarbons (PAHs) are contaminants commonly found in any urban environment. In addition, other contaminants can also be found in areas near former commercial or industrial properties. Table 1 lists sources of contamination that are commonly found on sites with a commercial or industrial history.

Table 1. Common Sources of Contamination[1]

General Source	Examples of Previous Site Uses	Specific Contaminants
Paint (before 1978)	Old residential buildings; mining; leather tanning; landfill operations; aircraft component manufacturing	Lead
High traffic areas	Next to heavily trafficked roadways or highways; near roadways built before leaded fuel was phased out	Lead, zinc, polycyclic aromatic hydrocarbons (PAHs)
Treated lumber	Lumber treatment facilities	Arsenic, chromium, copper
Burning wastes	Landfill operations	PAHs, dioxins
Contaminated manure	Copper and zinc salts added to animal feed	Copper, zinc
Coal ash	Coal-fired power plants; landfills	Molybdenum, sulfur
Sewage sludge	Sewage treatment plants; agriculture	Cadmium, copper, zinc, lead, persistent bioaccumulative toxins (PBTs)
Petroleum spills	Gas stations; residential/commercial/industrial uses (anywhere an aboveground or underground storage tank is or has been located)	PAHs, benzene, toluene, xylene, ethyl benzene
Pesticides	Widespread pesticide use, such as in orchards; pesticide formulation, packaging and shipping	Lead, arsenic, mercury, chlordane and other chlorinated pesticides
Commercial/industrial site use		PAHs, petroleum products, solvents, lead, other heavy metals (such as arsenic, cadmium, chromium, lead, mercury and zinc)
Dry cleaners		Stoddard solvent and tetrachloroethene
Metal finishing operations		Metals and cyanides

EPA's Toxic Release Inventory (TRI) can provide information to communities about sites where contaminants were released into the environment. The Envirofacts database allows users to enter location information, such as zip code, address or county location, to get information about releases in their area. The database is available online at: www.epa.gov/enviro.

1 Adapted from Heinegg, A., Maragos, P., Mason, E., Rabinowicz, J., Straccini, G. and Walsh, H. (2000) Urban Agriculture and Soil Contamination, available at: http://cepm.louisville.edu/Pubs_WPapers/practiceguides/PG25.pdf.

What Are Soil Background Levels?

Background levels are the naturally occurring levels of elements and chemicals found in any soil. Background levels differ depending on the region of the country in which you live. In some areas background levels for certain elements and chemicals may be higher. Contact your local extension service or state environmental agency (see Technical Assistance in the Resources section, page 10) for help in learning more about elemental background levels for the soil in your neighborhood.

More information on soil background levels in the United States is available at: http://pubs.usgs.gov/of/2005/1253/pdf/OFR1253.pdf.

Contaminants continued

Q: How Do I Know if My Property is Contaminated?

A: You can conduct a formal environmental assessment (study) of the land you are interested in using for urban gardening. There are two types of assessments: Phase I and Phase II Environmental Assessments. A Phase I assessment includes a review by a trained environmental professional of historical site uses, interviews with neighbors and, if possible, site owners, and a visual site inspection to determine the potential for and type of contamination at a site. If a Phase I assessment determines that there is potential for contamination at the site, a Phase II assessment is conducted to sample for contaminants and locate any impacted areas.

For more information on Phase 1 and Phase 2 assessments, contact your local and state environmental agencies. Some local governments may even be able to provide you with a Phase I or Phase II environmental assessment or have qualified environmental professionals on staff who can conduct the assessment.

Q: What if My Community Needs Help with Site Assessments, Sampling or Cleanup?

A: Federal funding is available to government entities to conduct brownfields (property where reuse may be complicated due to on-site contamination) assessments. Working with local officials to apply for an EPA brownfields grant can provide money for your community to assess or clean up the property you are interested in as well as address other properties.

What you need to know to get started in applying for brownfields grants can be found at: www.epa.gov/brownfields/grant_info/assess/assessment_factsheet.pdf.

Biosolids

Biosolids are the nutrient-rich organic materials resulting from the treatment of sewage sludge (the name for the solid, semi-solid or liquid untreated residue generated during the treatment of domestic sewage in a treatment facility). When treated and processed, sewage sludge becomes biosolids, which are tested for safety to be recycled and applied as fertilizer to improve and maintain productive soils and stimulate plant growth. Only biosolids that meet the strictest state and federal standards can be approved for use as a fertilizer.

More information on how biosolids have been used to solve problems on potentially contaminated lands is available at: www.cluin.org/ecotools/soil.cfm.

More information on biosolids is available at: http://water.epa.gov/polwaste/wastewater/treatment/biosolids/genqa.cfm.

More information for the urban gardener on soil science, effects, and additional links is available on EPA's CLU-IN