

A guide for building healthy soil in your garden

Dig In.

Healthy Soil Resource Guide

HEALTHY
SOIL
HEALTHY
COMMUNITY



A Food Well Alliance Collaborative

Sponsored by



Designed and Printed by

creative
approach
DESIGN. PRINT. INNOVATE.

1080 W Peachtree St NW | Atlanta GA 30309 | 404.480.8222

Dig In.

Healthy Soil Resource Guide



A Food Well Alliance Collaborative

Healthy Soil Resource Guide

Healthy Soil, Healthy Community is an initiative funded by Food Well Alliance. The Healthy Soil Resource Guide was curated by our partner organizations, who are invested in the conservation of Earth's precious soil. Through this Resource Guide you will understand the fragility and importance of the living organisms in soil, how to preserve the soil in your garden and methods to start your own composting system. Also visit www.foodwellalliance.org/compost for additional resources.

PARTNERS

Atlanta Community Food Bank's Community Gardens
Global Growers Network
Park Pride
Terra Nova Compost Cooperative
Truly Living Well
University of Georgia Extension
The Agency for Toxic Substances and Disease Registry

FIRST PRINTING: AUGUST 2015

TABLE OF CONTENTS

About Soil

- The Soil Profile
- Functions of Soil's Organisms
- The Components of Healthy Soil

Soil Care

- 7 Ways to Care for Your Soil

Composting

- Compost Basics
- What Do I Use to Make Compost?
- How to Start a Compost Pile
- Vermicomposting
- Common Compost Questions



The soil under our feet is alive!

Soil is made up of minerals, organic matter, water, air, and many living things. Just a spoonful of soil contains more living organisms than there are human beings on Earth! Soil is the top layer of the Earth's surface, and its health determines how well plants grow.

Farmers and gardeners know it is important to feed and care for the soil in order for it to produce food, flowers and other plants.



ABOUT SOIL

When we talk about soil in a general sense, or as it relates to gardening, we are really talking about topsoil. Topsoil is the “top” or visible layer of soil, but what’s below is just as important as what we see and cultivate. Topsoil refers to the first top 6-8 inches of soil, where most of the plant roots, organic matter, and biota exist. A soil profile will offer information about each of the three soil layers (called horizons)—topsoil, subsoil, and parent material.

Topsoil is made up of three main components – minerals (sand, silt, clay), organic matter, and living organisms. Minerals are broken down from parent material below, and/or other nearby rocks. Organic matter is degraded, or partially degraded, remains of dead plants and animals. There are also other living organisms that reside in the soil, plus air and water help to make topsoil.

Functions of soil’s organisms

The living organisms in soil have very important functions. For example, certain microbes can break down resistant organic matter such as lignin (found in trees and other woody plants), or chemicals such as toxins and pesticides.

Bacteria - an essential group of soil microorganisms too small to see without a microscope - and fungi, are responsible for much of the decomposition of organic material in soils. They are usually present in topsoils in very large numbers, and play an important role in converting more inert forms of nitrogen to ones that are easily taken up by plants.

Earthworms are another vital species because they help in the decomposition of organic matter in soil, as well as improve vital functions such as aeration, water infiltration, and drainage.

The components of healthy soil.

Soil structure

Soil can be described as well-structured or poorly structured depending on how soil particles are arranged. Well-structured soil will display "aggregates" or loosely grouped particles held together by organic matter and sticky secretions from microorganisms living in the soil. Well-structured soil contains small pockets of air that can help prevent compaction (a common problem in clay soils). These pockets also allow water and plant roots to penetrate the soil more easily. Nutrients stick to the aggregates in the soil, keeping them at the soil surface where plant roots can access them as needed. Lastly, these aggregates help protect against natural erosion from wind and water by holding the soil in place. Soil erosion can occur when there are not enough plants to hold the soil in place.



The pH level

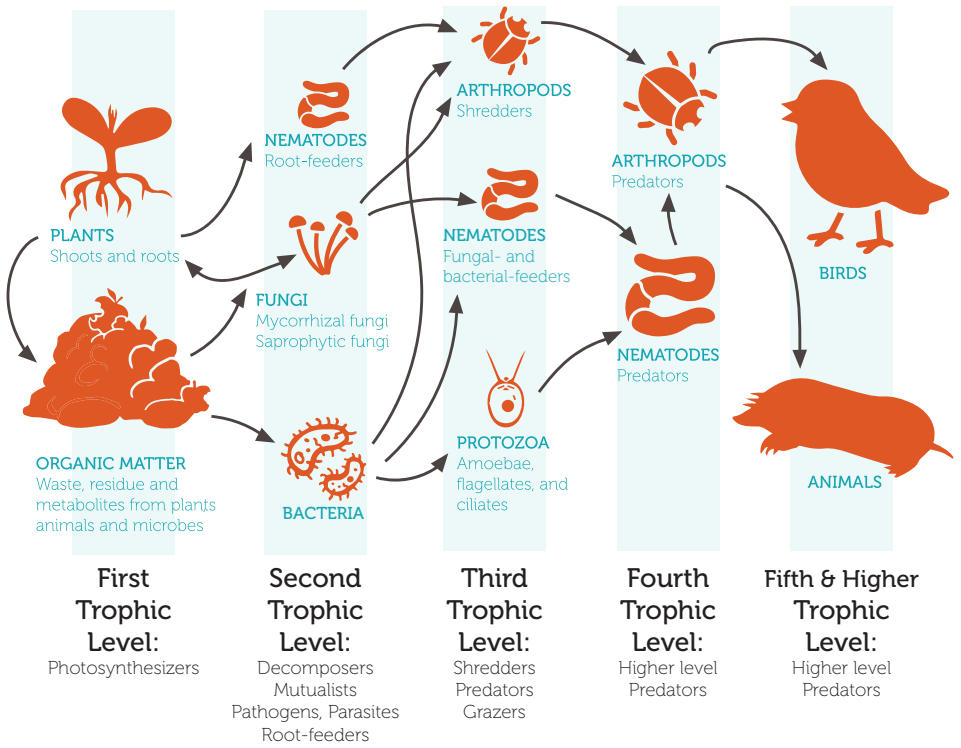
The pH level measures a substance's acidity and alkalinity based on a scale from 0 to 14. The average plant grows between a range of 5.5-7.5, where nutrients thrive and contaminants are less likely available. Inversely, when pH levels are very high or very low, nutrients are less available. Also, at very high and very low pH levels, any contaminants (lead, for example) present in soil are available to plant roots.

What else might be found in my soil?

Urban environments are filled with industrial enterprises and cars that can contaminate the air, water, and even soil. Typical sources of contamination that could be of concern for urban vegetable gardens are lead paint (used in buildings built before 1978), lead deposits from leaded gasoline, treated wood or railroad ties, and past dumping. Soil testing is important in urban areas to determine if there are enough nutrients to grow plants and if there are any lingering contaminants. Children playing in urban lots are most at risk if there are pollutants. It is recommended that you test for contaminants.



THE SOIL FOOD WEB



The best thing you can do for your soil is to simply remember that it is alive. It needs water, air, and food—just like us!

View the Soil Food Web above for examples of organisms that live within soil.



SOIL CARE

7 ways to care for your soil:

1 Compost!

Adding organic matter to your soil is perhaps the most important thing you can do to maintain soil health. Adding finished compost can improve the structure of any type of soil from sandy soils to heavy clay soils.

Compost does not contain sufficient macro-nutrients to be considered a fertilizer, but it is valuable to plant growth all the same. Compost slowly releases nutrients throughout the growing season and can prevent erosion and improve water retention. Adding compost to your soil can bring its pH level closer to neutral. Compost also offers an advantage in disease and pest suppression, which fertilizers do not (organic or chemical).

(See page 13 for more details about composting)

2 Cover crops

Bare soil is vulnerable to erosion by wind and water; it also loses carbon due to the sun's rays. Cover crops aren't just for farmers! Everyone can and should, keep their soil covered at all times. Once you've harvested your fall crops, prepare the soil and plant a cover crop to grow through the winter. Legumes (clovers, alfalfa, beans and peas) are especially valuable cover crops, because they transform nitrogen from the atmosphere into forms available to crop plants. Red Clover is another good choice because bees and other pollinators love it *(see image above)*. Fava beans is another great choice, as it improves the soil and is edible. In the springtime, simply turn the soil (clover and all!) and plant your spring garden.



3 Deep-rooted plants

Plants with deep roots can “mine” nutrients that shallow-rooted plants cannot reach. In the mining process, plants like comfrey (*pictured above*) and stinging nettle reach deep into the soil with their roots to source nutrients (like nitrogen) and bring them closer to the surface. Both of these perennials can be used medicinally, as a mulch made from the cut leaves, or simply added to the compost pile.

4 Mulch

Spread mulch around plants and on the rows to suppress weeds, retain soil moisture, moderate soil temperature, prevent soil erosion, and decrease disease and pests.

5 Minimize soil disturbance

As mentioned earlier, the soil under our feet is full of life. Soil is “bound” together by secretions from microorganisms and mycelium (spiderweb-like fungi) that improve soil structure, nutrient availability, and water retention. Tilling the soil disrupts the soil creatures’ habitat and their intricate web of activities like decomposition and nutrient cycling. Also, carbon that is stored in the soil is released into the air by plowing and tilling. To minimize soil disturbance, apply compost directly to the soil surface, in the planting hole, or as a side dressing next to existing plants.



6 Crop rotation

All crops take varying amounts of nutrients from the soil, and others add nutrients to the soil. To maintain good production, it's best to rotate a variation of plants season after season. Heavy feeders such as cabbage, kale, broccoli and radishes can be swapped with peas and beans to restore nitrogen in the soil (*see below*). Crop rotation also allows gardeners to interrupt the life cycle of pests and diseases so they cannot become established.



7 Green manures

Unlike most crops, green manure crops are grown to feed the soil, not humans. Mustard (*pictured below*), white clover, buckwheat, and red clover are all green manures. Growing green manure crops adds organic matter to your soil, keeps nutrients from leaching below the reach of crops, provides food for microbial soil life, helps legumes restore nitrogen in their root nodules, and helps the soil produce good structure and maintain the air-pore spaces essential to good crop health. Once the green manures flower, just turn them into the soil and plant your edible crops!







COMPOSTING

Composting basics

The first thing a community gardener can do to enhance the soil is to have a ready source of humus. Luckily, a compost pile is a low-tech, low-cost way to make humus. Referred to as 'black gold' by farmers, humus has been used to enrich farm and garden soils for thousands of years, long before synthetic fertilizers arrived on the scene in the 1950s. Composting is a sustainable process in which organic material is piled up for nature to decompose into simple nutrients for plants to absorb. The end product—humus—contains nitrogen, phosphorus, potassium, calcium, and other trace minerals essential to plant growth.

What are great ingredients for composting?

Nearly anything that once lived is a candidate for a backyard compost pile. Grass clippings, dry leaves, vegetable peelings, eggshells, wood ashes, corn cobs, spent tomato vines, hair clippings, coffee grounds, and tea bags are all excellent ingredients for homemade compost. A more diverse pile is likely to decompose faster, maintain a higher internal temperature, and contain a greater variety of needed nutrients. That is why, a diverse mixture works best for composting.

How to start a compost pile?

The following recommendations ensure proper decomposition. The pile or container should be at least 3-4 feet by 3-4 feet. Smaller piles will not heat up enough to kill weed seeds and disease, and a pile much bigger is difficult to turn.

Contents

Place coarse material, such as twigs and short lengths of small tree limbs, at the bottom of the pile to provide good air circulation.

Chop and chip larger material if you want your pile to decay quickly. Take the time to chop up large fibrous materials such as woody stalks and small branches, and chip larger branches and tree trunks.

Examples of “green” and “brown” materials

Compost ingredients are organic materials that contain carbon and nitrogen. They are classified as either “brown” (those high in carbon) or “green” (those high in nitrogen). Examples are listed below.

COMPOST PILE INGREDIENTS

Browns - Carbon Sources

Woody prunings, brown leaves,
straw

Cardboard egg cartons, shredded
paper bags, newspaper

Wood chips, dryer lint,
cotton fabric

Greens - Nitrogen Sources

Grass clippings, discarded plants
including house plants

Fruit and vegetable scraps,
egg shells, bread

Coffee grounds and filters,
tea bags, spent beer grains



Location

Choose a leveled, well-drained location, preferably near your garden. If possible, place the compost pile in partial sun to help heat the organic matter.

Place the compost pile away from the neighbors' homes so any foul odors will not waft into nearby yards. However, a properly maintained compost pile will NOT emit any foul odors. Position your compost pile at least 50 feet from streams, rivers, and ponds to prevent compost nutrients from washing into the water during a rainstorm.

Building your pile

Build your pile directly on the ground, or buy (or build) a container. Depending on your preference, cone-shaped, rectangle, square, and round bins are all available to purchase.

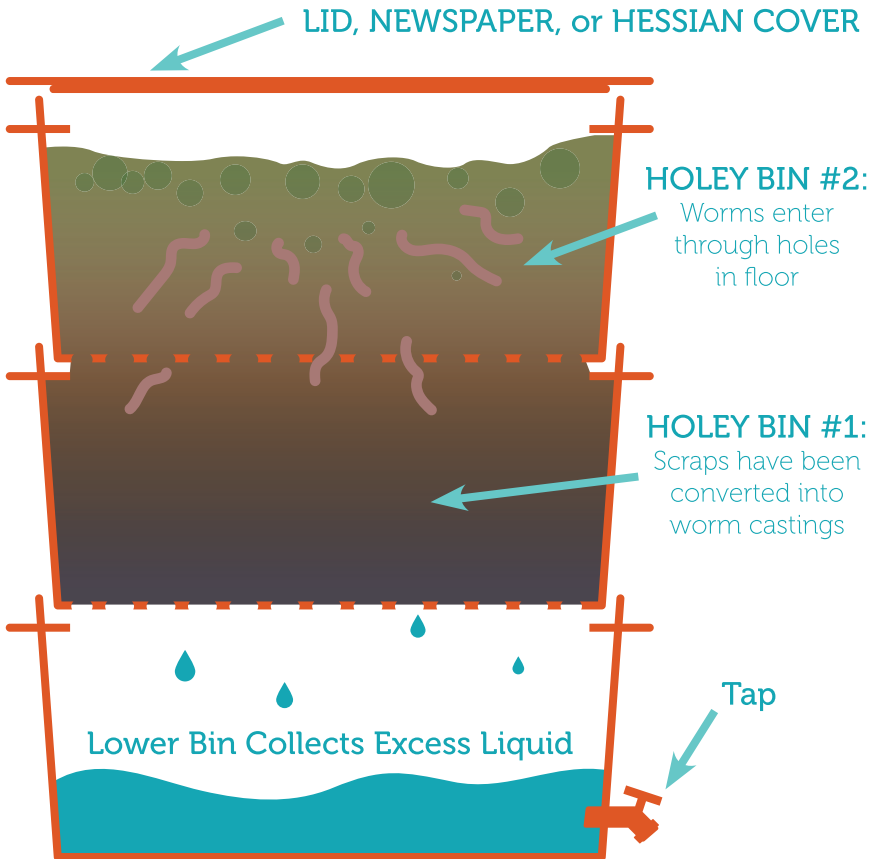
Layering "greens" and "browns" is often recommended, but not necessary. If you would like to layer, use 3-4 inches of "brown" material topped by 3-4 inches of "green" material (see picture above for example).

Monitoring and maintenance

Turn the pile at least once each month to move less decomposed matter into the middle of the heap, and to keep offending odors masked. As organisms start to break down all the layers, you will notice that the center of the pile becomes very hot, 130° -160° F; this means the pile is decomposing and you're making compost!

Worm Composting (Vermicompost)

High-fertility compost can be made by housing worms in a bin such as a garbage can or wooden crate and feeding them vegetable scraps. Good drainage is vital because worms can drown in wet conditions produced by kitchen waste. Worms process food slowly, so don't overfeed them. Excess food in the bin may rot, and worms will not touch it, consequently creating a foul smell. If you have a high volume of rotting nitrogen materials, mix in moisture-absorbing materials such as newspaper, cardboard tubes, and paper towels. Worm compost makes a great top dressing for vegetable gardens and can be used to enrich commercial potting mix. This is a good alternative to a traditional compost pile, if your waste is mostly kitchen scraps. Vermicompost can be done in a small space and has a higher nutrient value than traditional compost.



Common Compost Questions

When is it ready?

Compost is ready when the humus is dark brown or black and resembles commercial potting soil, but contains more lumps. Worms should be burrowing through the soil. It should smell earthy, and not have a rotten stench.

What if the compost pile stinks?

If the compost pile smells bad, it is probably due to a lack of air or too much nitrogen-rich material such as kitchen scraps and grass. Increase the "browns," such as leaves and twigs, and turn the pile more frequently to introduce oxygen.

What if animals are attracted to the pile?

No doubt, kitchen waste such as watermelon rinds and spoiled lettuce may entice the local turtles, raccoons, dogs, and cats to stop by for dinner. Bury kitchen waste in the pile or shovel soil over it to discourage hungry animals from scavenging. Do not add meat scraps to the bin because that will attract rodents.

How long does composting take?

It depends on many factors, including the composition of the original ingredients, whether the pile is in the sun or shade, temperature, and water. In summer, compost could be ready in three months if the pile is turned each week, watered, and fed the correct ratio of "greens" to "browns". Otherwise, it may take up to one year. Once compost is ready, it can be used to improve clay and sandy soils, and to act as mulch for annual, perennial, and vegetable beds. Complete decomposition is not necessary when using compost as mulch. In time, the mulch will decompose and become part of the soil. When the compost looks like dark soil, has worms burrowing through it, and the original ingredients are not recognizable; it's ready.

For more information on classes and technical assistance:

University of Georgia Extension

www.extension.uga.edu
(800) ASK-UGA1

Terra Nova Compost Cooperative

www.terranoacompost.com
(678) 786-6568

Truly Living Well

www.trulylivingwell.com
info@trulylivingwell.com
(678) 973-0997

Park Pride

www.parkpride.org
(404) 546-7982

Global Growers Network

www.globalgrowers.org

Atlanta Community Food Bank's Community Gardens

www.acfb.org
gardens@acfb.org
(404) 892-FEED (3333) x1216

The Agency for Toxic Substances and Disease Registry

www.atsdr.cdc.gov/sites/brownfields
ATSDR.LandReuse@cdc.gov
(404) 747-4451

Food Well Alliance

www.foodwellalliance.org
(470) 588-4585

HEALTHY SOIL, HEALTHY COMMUNITY IS A COLLABORATIVE INITIATIVE WITH THE FOLLOWING PARTNERS:



The mark "ATSDR" is owned by the U.S. Department of Health and Human Services and is used with permission. Use of this logo is not an endorsement by HHS or ATSDR of any particular product, service.