



Safer
BRAND

Way
to
Grow

The Secret's in the Soil

THE KEY TO SUCCESS IN GARDENING IS BURIED BENEATH YOUR BEDS.

Most of the action in your garden appears to be aboveground, where you can see the green growth coming up in the sunshine. But below the surface, plants' roots and billions (really, billions) of microbes are working together to gather the critical water and nutrients needed to make all that green growth—and your harvest—happen. In healthy, fertile soil, those microbes thrive so your garden plants come up big and strong, are able to fend off pests, and produce a hefty harvest for you. And here's the best news: You can transform even poor dirt into the best garden soil in just seven steps.

1. KNOW YOUR SOIL

Before you begin the journey to super soil, you need to know where you are. We'll start with a quick peek underground, explore the three main types of soil, and tell you how to get a read on yours.

Soil Food Web

Soil is made of tiny bits of crushed minerals and decaying plants, held together by fungi. Healthy soil is also home to billions (literally billions) of organisms, from earthworms and insects you can see to countless microscopic protozoa and bacteria. All of these interdependent species function as nature's recyclers: They consume all that is dead and decaying, and they leave behind the building blocks for new growth. The building blocks are nutrients that plants' roots take up to fuel their growth. Scientists have recently discovered that each plant releases compounds into the soil that attract the specific kinds of microbes it needs to grow best.

The primary food for the whole soil food web is organic matter—essentially, dead and decaying plants. If you do just one thing for your garden, keep it well-fed with organic matter. We'll explain how on the coming pages. For now, just remember this: If you think of yourself as a microbe rancher, you'll become a more successful gardener.

Sand, Clay, and Loam

The texture and density of soil dramatically affects its capacity for holding and dispersing moisture and nutrients, and the ease with which roots can spread. Soil that is predominantly sandy—common in coastal regions around the United States—is loose and porous, so roots can grow freely. Sandy soils, however, dry out very quickly and tend to be light on nutrients. Soil with high

clay content—typical in the Northeast and Midwest—is very dense, holding onto water and nutrients better than sandy soil. High clay soils are hard to dig, stay too wet, and restrict root growth.

The ideal soil is loam. It's loose enough to scoop up with your hand, but forms a soft ball when you squeeze it in your palm. Loam is dark brown and has a sweet, earthy aroma. If you have loamy soil in your garden already, congratulations! You can make sandy and clay soils more like loam. Just remember to continuously feed the soil food web with organic matter, especially compost.

MEASURING DRAINAGE

Most garden plants drown when the soil stays soggy for too long, but dehydrate when the moisture drains away before their roots can soak it up. Here's a simple test from the Cornell University Cooperative Extension Service that you can use to tell if your garden beds have good drainage: Dig a hole 1 foot deep, fill it with water, and wait until the hole drains completely. Immediately refill the hole with water and measure the water's depth with a ruler. Wait 15 minutes, then measure the drop in water in inches. Well-drained soil loses 1 to 6 inches of water per hour.

SOIL TEST

Have your garden soil tested by lab—especially when you are starting a new bed—and you'll get vital information on its nutrient and organic matter content, as well as its pH, helping

you determine where it has room for improvement. A 5% organic matter content and a pH from 6.0 to 6.5 is ideal for vegetable gardens. Every county has a cooperative extension

office (locate yours at csrees.usda.gov/Extension/), where you can find out how to get a low-cost soil test. Wait for the results before amending the soil with anything but compost.

QUICK TIP

TAKE SOIL SAMPLES FROM DIFFERENT SECTIONS OF YOUR GARDEN AND MIX THEM TOGETHER BEFORE SENDING THEM IN FOR A TEST. THIS ENSURES YOUR RESULTS ARE ACCURATE AND APPLICABLE TO YOUR WHOLE GARDEN.

2. MAKE YOUR BED

Whenever you are starting a brand-new bed or getting ready to plant in an existing one, you have the chance to work on improving the soil. In that process, you can make a dramatic difference for your garden's success if you create raised beds. When you build up your beds 4 inches or more above the surrounding soil, you give roots room to spread out, ensure consistent drainage, and create pores in the soil where air and water are accessible by the roots.

Preseason Prep

Begin getting your garden beds ready about four to six weeks before you intend to plant in them. Dig down about 8 inches and remove the soil.

Use a shovel or garden fork to loosen the soil another 4 to 6 inches deeper. Break up any big clods of soil that you see and rake out clumps of weeds and grass.

Mix compost or composted manure (never raw manure; more about that on page 3), grass clippings, shredded leaves, or peat moss with the soil you dug out. You need a soil test to know if you need to adjust the pH or need to add minerals. If the results show you need to add lime or other

organic soil amendments, mix them with the soil and compost before backfilling the hole. Rake it level.

Cover the bare soil with a 2-inch-thick layer of grass clippings, shredded leaves, or straw, and check on it every few days. You will soon see weeds sprouting up—turning the soil moves seeds to the surface. Pull them before they get established. When you're ready to plant, use a rake or garden fork to break up soil that has crusted over since you first dug it. Water it well, but don't soak it. As you plant, and anytime you work in your garden, avoid stepping on your beds, which compacts vital pockets for air and water in the soil.

LASAGNA STYLE

An easy way to start a new, rich bed is to make lasagna. Well, sort of. Spread a base layer of 1 inch of newspaper or cardboard; wet it down. Top with a "brown" layer (leaves, peat moss, shredded paper); top that with a "green" layer of kitchen waste (fruits, vegetables, etc.). The layers smother the grass and weeds and as the organic matter breaks down, it builds the soil beneath. Make soil lasagna in fall, and by spring the bed will be ready.

GIVE YOURSELF A RAISE

Digging and loosening the soil down about a foot, and adding compost to it, elevates your garden bed a few inches above the grade. Raising it even higher—to 6 or more inches above the paths around it—significantly improves its drain-

age and allows roots even more room to grow. Gently rake soil into the bed from the areas around and between them. The ideal width for a raised garden bed is 4 feet, because it allows you to reach into the middle of it to weed or harvest from one side

or the other, without stepping on the growing area. You can frame a raised bed with wood, bricks, cinder blocks, stones, or other found materials, but a frame is not essential. Unframed beds erode gradually, but you can build them up each season.

QUICK TIP

DON'T ADD PLAYGROUND OR OTHER FINE-GRAINED SAND TO CLAY SOIL—IT INCREASES THE SOIL'S CLUMPINESS, RATHER THAN REDUCING IT.

3. FEED THE WEB

Regardless of what synthetic fertilizer companies want you to believe, plants grow up healthiest and well-fed when you nourish the microbes in the soil rather than the plants. Synthetic fertilizers are like steroids in people—they generate dramatic growth, but the plants are pushed beyond their natural growth rates and become vulnerable to problems. And the synthetics disrupt the soil’s ecosystem. Organic fertilizers are packaged organic matter, the natural diet of soil organisms. They consume it and release the nutrients gradually, in exactly the form plants have evolved to take them up.

Organic Diet

The main ingredients in organic fertilizers are natural, like feather meal (a by-product of poultry processing) and guano (seabird manure). Synthetic plant foods are typically made with ammonium nitrate or urea, petroleum products that are high in salts, which dehydrate the microbes and the soil. Because organic fertilizers are processed slowly by soil-dwellers, the nutrients become available to plants over a long period. When plants don’t absorb nutrients from synthetic fertilizers right away, they run off during downpours and wash into freshwater sources, fueling unnatural and destructive growth of algae and other plants.

The ideal time to add dry (referred to as “granular”) fertilizer to the soil is about two weeks before planting. It begins to decompose and its nutrients become available to roots just when they are in need of the nourishment. Be sure the ground is moist to activate the microbes that

will break down the fertilizer. With a hoe or rake, mix the plant food into the top 6 inches of soil.

You can reapply fertilizer 45 to 60 days after planting for heavy feeders such as pumpkins and watermelons.

For container-grown vegetables and flowers, skip the potting soil with the synthetic fertilizer crystals and use peat and compost blend. Feed container plants through the season with liquid organic fertilizer.

MINERAL MATTERS

If a soil test reveals a shortage of key micronutrients, look for natural sources to replenish them. Greensand is a mined source of iron, magnesium, and other valuable elements. Rock phosphate and bone meal increase phosphorus, a nutrient essential for blooming and fruiting. Agricultural gypsum provides calcium and sulfur, while kelp meal adds potassium.

THE POOP ON...

Farmers have long relied on nitrogen-rich manure from their livestock to improve the soil’s fertility, and you can too. You may be able to get it from a local farm, zoo, or stables. Be sure to

use manure only from herbivores, such as poultry, cattle, horses, or sheep, and let it decompose in your garden soil for at least three months before you plant in it; better yet, compost it. If you

have rabbits or guinea pigs, their droppings also work as fertilizer for your garden. You can buy bags of manure from worms and even crickets, which, though pricey, are rich in nutrients.

QUICK TIP

RESIST THE TEMPTATION TO OVERFERTILIZE WITH THE HOPE OF SPEEDING PLANT GROWTH. THE EXCESS PLANT FOOD IS NOT ABSORBED BUT RATHER WASHES AWAY, WASTING YOUR MONEY AND POLLUTING WATER.

4. KEEP UP MULCH

Mulch is a blanket that helps the soil stay moist and prevents weeds from getting sunlight and sprouting up. And, just as important, when you use natural materials for mulch, they feed your soil as they age and break down. Many of the best mulches for your garden are free and easy to find—in fact, they're already in your yard. All you need is a little diligence: Remember to cover the soil at the start of the season, and never leave it exposed. In exchange, you save yourself so much weeding and watering, and your soil gets the steady dose of organic matter that keeps it healthy and fertile.

Which Mulch?

Let's start with the most readily available choices. Grass clippings from your lawn and fall leaves you mowed and bagged are very effective as mulch, and they're loaded with nutrients.

Remember to apply only organic fertilizers and weed controls to your lawn when using the clippings and leaves for mulch in a food garden.

If you don't have enough grass clippings or leaves for your beds, pine needles or straw work well too. Be sure to get straw, which is only stems, not hay, which includes seeds that become a weed problem next season.

Bark chips, shredded hardwood, and other woody materials help prevent weeds and retain moisture, but they

break down too slowly to feed the soil. They are best used around shrubs and in flower beds.

Want the ultimate soil-building plan? Grow living mulch when your garden is dormant. Cover crops (aka living

mulch) are legumes or grains that add organic matter, prevent erosion, break up heavy soil, and, when they're done growing, blanket the soil. Buckwheat is fast-growing and easy to manage even in small gardens. Clover and vetch, like other legumes, extract nitrogen from the air and store it in the soil. Plant the living mulches in the fall; when they're dead the following spring, you just dig holes or trenches right through them to plant your crops. As they continue to decay, the soil grows richer and richer.



HOW MUCH MULCH?

Spread a 3- to 5-inch layer of grass, leaves, or straw on your garden as soon as you transplant seedlings or when seeds have sprouted. While

plants are small, leave a couple inches of room (with no mulch) around their stems to keep the seedlings from becoming too damp and

vulnerable to fungal diseases.

QUICK TIP

STUDIES SHOW THAT EIGHT SHEETS OF NEWSPAPER (BLACK-AND-WHITE PAGES ONLY) BENEATH A THIN LAYER OF ORGANIC MULCH PREVENTS WEEDS BETTER THAN THE MULCH ALONE.

5. COMMIT TO COMPOST

We've already covered how vital organic matter is to your soil. Compost is the best kind of organic matter because it feeds the existing microbes and increases their population. It also absorbs moisture and releases it as needed. It adjusts the soil pH to the right level and turns clay or sandy soil into loam. Bonus: Composting is an easy way you can help the environment by recycling your waste into a valuable resource for your garden. If you have no place to make compost, you can buy it in a bag at your local garden or home center.

A Heap of Good

Compost is simply a mix of plants in advanced stages of decay. You make compost by blending wet and nitrogen-rich (green) ingredients with dry (mostly brown) carbon. Kitchen scraps, like carrot tops, apple cores, and watermelon rinds, and spent garden plants work well for greens. You can use grass clippings—if you leave them to feed your lawn, you can ask your neighbors for theirs (but only if they don't use lawn chemicals on it). Fall leaves, straw, and shredded newspaper (the black-and-white newsprint pages only) are available carbons. Manure from herbivores, coffee grounds, and eggshells pump up nutrients in a compost heap.

Gather your ingredients and pile them up in a spot that's at least 3 feet

wide by 3 feet long. To kick-start the decomposition process, you can mix in Ringer® Compost Plus, a unique blend of critical microorganisms that rapidly multiply and begin transforming the raw organic matter into compost right away. Keep the pile damp, but not soggy.

TO BIN OR NOT?

You can make compost right on the ground, but a bin can keep it neat and make it easier for you to manage. With a few wooden pallets held together by wire or a circle of chicken fencing, you can make your own bin. Or you can buy an attractive one with features that help you turn the ingredients with less effort. If you have no room for a compost pile, consider buying a tumbler-style bin that can sit on a porch or any out-of-the-way place.

When your compost heap reaches 3 feet tall, it starts to heat up, getting as warm as 160 degrees F. Dig into the center and you'll see a wisp or two of steam. With a shovel or garden fork, turn the pile every other week, moving the warm, decomposed material in the center to the outside and shift the still-raw ingredients surrounding it to the hot center. Your compost is finished and ready for you to use when you can no longer recognize the ingredients and it looks like crumbly, dark chocolate cake crumbs.

USING COMPOST

Compost helps you build your soil throughout the growing season. Mix compost with the soil when preparing your garden beds (as described

on page 2). Spread a half-inch layer of compost on your beds just before planting and lightly scratch it into the surface. Replenish that layer every

month, if possible. If you grow your own transplants, mix compost with peat in equal portions to make the perfect seed-starting soil.

QUICK TIP

THE SMALLER THE PIECES YOU PUT IN YOUR COMPOST PILE, THE MORE QUICKLY THEY DECOMPOSE. BREAKING UP BIG MELON RINDS AND SQUASH SKINS IN A FOOD PROCESSOR REALLY SPEEDS THEM ON THEIR WAY TO BECOMING COMPOST.

6. TILL WITH CARE

Tillers are powerful machines that farmers depend on, and many gardeners today use them too. They can reduce back-breaking labor and help build better soil. But tilling can also be counterproductive for gardeners, undermining your efforts to improve the soil's fertility and nurture its ecosystem. Before you fire up your tiller, find out when and how to use it most effectively, and when not to.

Breaking Ground

When you're starting a new garden where none has been before, the sharp, rotating tines on a tiller break through the mat of roots and clumped soil that's in the top layer of soil a lot easier and faster than you can with a shovel. In most cases, two passes (in cross directions) through the garden are enough to break up the soil and roots. Use a rake to bust up any remaining clods and to level the soil.

Many gardeners till their beds ritually each spring. If you've layered on organic matter, manure, and other soil amendments, tilling blends them with the soil so the microbes can feed on them. When you've grown a cover crop, a tiller carves a neat plant-

ing row through it. After one crop is finished and you're ready to replace it with another, you can till it into the soil and dig a furrow for planting.

Tillers come in three basic styles: rear-tine, front-tine, and handheld. Rear-tine models are the most powerful tillers, and are best-suited to cutting through sod to create a new garden bed. Rear-tine tillers are too big for annual use in a small- to medium-size garden, so you are better off renting one when you need to at a home and garden center or hardware store. Front-tine types are smaller, lighter, and more maneuverable, and work well for tilling in cover crops and soil amendments. Handheld tillers quickly dig furrows in existing garden beds.



OVERTILL IS OVERKILL

As with all good things, too much tilling can be harmful to your soil. Frequent tilling—especially when the soil is very dry or wet—batters the soil's texture, leaving it dusty or clumpy. Running a heavy tiller back and forth over your garden beds as

you walk behind it compacts the soil, squeezing out pores where air and water collect. Overtilling also disturbs earthworms, fungi, and many of the other beneficial creatures in the soil. If you own a tiller, you may be tempted to use it regularly to control

weeds between rows. Mulch is a much better way to control weeds, because it adds organic matter and lets the soil food chain function naturally. Refrain from tilling your garden more than twice a year, in spring and at the end of the season.

QUICK TIP

ONCE YOU'VE ACHIEVED SOIL THAT'S RICH IN ORGANIC MATTER, A SPADING FORK OR A BROADFORK IS A BETTER WAY THAN TILLING TO "FLUFF" YOUR SOIL WITHOUT TURNING IT OVER EACH SPRING.

7. READ THE SIGNS

While you can't see what's going on in your soil without a microscope, you can learn a lot about it from observation. And what you discover can make all the difference between plants that survive and plants that thrive. Look for these clues to help show you what's happening underground.

Important Messages

When plants grow big and leafy but bear little fruit, the soil likely has too much nitrogen. This is not uncommon with excessive applications of synthetic fertilizer, but it also can happen if you use too much manure or don't allow enough time for it to decompose before planting.

You can help remedy the problem by mixing carbon-rich materials such as shredded leaves or wood ashes (from a fireplace or wood stove) into the soil.

Plants that do not grow vigorously or that look pale and weak may be deficient in nitrogen. But before you grab a bag of fertilizer, be aware that too much carbon in the soil binds up the nitrogen, making it unavailable to plants. When you turn deep piles of leaves that have not decomposed or any woody materials into the soil, you dramatically increase its carbon content. Instead of mixing raw leaves into your soil, blend them with nitrogen-rich ingredients in your compost pile

and then add the balanced compost to your garden. Use bark chips and other woody mulches for pathways.

Puddles of water standing on your garden beds for hours after a rainstorm clue you in to poor drainage and often indicate that the soil is compacted, which means that spaces where air and water filter through the soil

have been pressed out. The best prevention for compaction is to avoid walking on your beds at all times.

However, clay soil is so prone to compaction that you always need to be working directly against it. Adding compost to the soil when you plant and periodically spreading a half-inch layer on top after planting reduces compaction by stimulating the activity of earthworms, which break up the soil as they tunnel through it to get to the compost. Using synthetic fertilizers increases compaction because they are high in salts that dehydrate the soil. Use compost and organic fertilizers instead.

SIMPLE ROTATION

Each crop you grow extracts and leaves behind different compounds in the soil. To help keep your soil well-balanced and to reduce the risk of plant-specific diseases building up in the soil, rotate the crops that you grow in each section of your garden from season to season. For instance, plant beans or lettuce where you grew tomatoes last year. A study at Michigan State University found that regular crop rotation also reduces the amount of fertilizers and pest control gardeners need to use. And you get to enjoy the variety of fresh food.

WEED WISDOM

The weeds that you see frequently in your garden can tell you about the soil's condition. Clover, for instance, grows where nitrogen levels are low. Broadleaf plantain establishes itself

in compacted soil. Purslane tends to show up in dry soil; nutsedge grows in wet soil. Identify the weeds in your garden and learn what conditions they prefer, and you'll find out

what's not ideal in your soil. Improve those conditions and you not only help your crops grow better, you also reduce the number of weeds that you have to eliminate.

QUICK TIP

CARTOONS ASIDE, NOBODY WANTS TO SEE — OR SMELL — A SKUNK. BUT SKUNKS DO FEED ON TWO SOIL-DWELLING PESTS THAT YOU WANT TO BE RID OF: GRUBS AND YELLOW JACKETS.