Our goals at Troy are:
- To keep organic resources on the land.
- To be sustainable, to keep the gardens healthy and productive long into the future.
- To live with a sense of community, sharing the care for the gardens.

What are the techniques for making good garden soil? **Add Organic Matter.** The three techniques are composts, mulches, and cover crops.

Compost is made by piling organic matter into a mound and letting it rot. Strive for a C:N ratio of 30:1. Green material such as grass clippings, fresh plant clippings, kitchen waste are high in nitrogen. Brown items such as dried leaves, hay, straw, and wood shavings are high in carbon. Mix roughly half green with half brown to get the ideal 30:1 C:N ratio. The layers should be no more than 6 inches, and should be watered as the pile is being built.

1 Teaspoon of healthy soil contains:
1 billion bacteria
1 million fungi
10,000 amoebas, protozoa, and nematodes

It is these and other organisms that do the work of creating healthy, rich soil. They hold onto nutrients that would otherwise be washed out of the soil into water bodies. If the soil life is starved, microbes do not pass on food to the plants. The saying is, “Until the soil is fed, the plants can’t eat.”

Toby Hemenway, in his book *Gaia’s Garden, A Guide to Home-Scale Permaculture*, gives an easy way to visualize and appreciate soil life. An acre of good pasture may support a horse or two, or about one-half ton of animals. But living in the soil of the acre may be two tons of worms and another two tons of bacteria, fungi, and soil animals such as millipedes and mites. The one horse-per-acre soil can contain eight or ten horses’ worth of animals below ground. Elaine Ingham, cofounder of a firm specializing in analyzing soil life, calls the swarms of subsurface livestock, microherds, to emphasize their importance.

Soil building is a complex biological process, and **microorganisms do the hard work**. There is a lifetime of reading and studying that can be done. But there are some basic principles that can get you started on successful compost building. There are many variations. Begin and Observe what happens.

If you’d like to contribute to the compost piles at Troy, you may. They are open to all Troy gardeners. When you are facing the gardens, there is one to the West (left) near the raspberries. Facing North (back) there is one near the wooden sheds. And when you are at the sheds, if you go to the East (right) there is a site there also. The total number of piles now is 10. There are also 2 brush piles, which are for larger materials such as corn stalks or sunflower stalks. One is at the back of the East location and one is North, past the Hmong garden, on the right.

We ask that you put all material into the receiving bin. *This is a 3-sided structure at the front of each site. If gardeners drop off their material, volunteers will do the layering to the specifications that we use (6 inches of greens, 6 inches of browns, water).*

Chop garden material to the correct size:
- No longer than 6 inches (about the length of your hand)
- No thicker than 1/2" (about the width of your finger)
- No rounder than 1-1/2" (about the size of a golf ball)

Organic plant material only
- No plastic, wire, latex gloves, lumber-garbage can for that.

Please bag these and remove them from the garden:
- No thistle
- No garlic mustard
- No diseased plants

Compost piles aren't the optimal way to raise your microherds or to use their gifts. Turning or moving piles kills microorganisms. Each disruption of the pile is a setback to soil life. So, the better solution is composting in place—sheet mulching. It is a variation on nature's way of building soil by accumulating and breaking down organic debris from the top down.

How To: Sheet Mulch

Sheet mulching is easiest to do in the fall, and it will break down considerably by spring, but it can also be done in any season. A mulched bed takes 1/10 the amount of moisture to keep the plants growing.

Sheet mulch can be as simple as a layer of newspapers topped by 8 to 12 inches of nearly any mulch material.

Sheet mulching is very forgiving. As long as you have enough newspaper or cardboard, plus organic matter of almost any kind, you'll end up with great soil. The day before you mulch, water the site well unless the ground is moist from rain. The organisms that will be turning your mulch into rich earth can't work without water, and once the mulch is in place, it takes a lot of water to moisten the bottom layers. Conversely, it takes a long time for the layers to dry out—you've got lots of water storage.

After the water has soaked in overnight, cut down any vegetation. Don't pull up weeds—leave all the native organic matter right there, including the roots. Just clip, mow, scythe, or weed-whack everything down in place. It's great worm food, and the nitrogen-rich greens and roots will be a tasty starter for the decomposers.

If your native earth is clayey or compacted, now is a good time to open it up a bit. Just push a spading fork into the ground, rock it a little, and pull it out. Do this across the

entire mulch site. Don't turn the earth, just poke some holes into it and crack it open to allow better moisture and root penetration and soil-critter movement.

Then add a thin layer of high-nitrogen material. This can be manure, fresh grass clippings or other lush greens, or cast-off produce from restaurants or markets. Grass clippings or bedding-rich manure should go down about an inch thick. While this layer isn't essential, it attracts worms and burrowing beetles, which will aerate and loosen the soil.

Lay down newspapers and/or cardboard to create a continuous light-blocking layer that will smother existing plants. On top of this, pour on the bulk mulch, about 8 to 12 inches of loose straw, hay, or other substances listed above. Weed seeds in this layer aren't a big concern, as a thick, seed-free stratum lies atop this one. Weed seeds seem to rot rather than germinate in the slowly composting mass.

Bales of hay or straw don't have to be fluffed up to their original grassy bulk. Just break the bales into thin "flakes" about 1 to 2 inches thick, and lay down about three thicknesses of these. Broken into several layers and moistened, the dense flakes will expands and compost perfectly well.

To create an easily compostable sheet mulch, pay attention to the carbon/nitrogen ratio in the bulk mulch layer. A mulch that is extremely low in nitrogen, such as wood shavings, will be slow to rot down. You don't have need a perfect C:N balance, just make such there's some nitrogen in the mix to feed the compost critters.

As you build this layer, spray on water every few inches. This layer should be damp but not wet; you're looking for that wrung-out sponge state. This can take a surprisingly large volume of water. It may take a couple of minutes of soaking every few inches to achieve the damp-but-not-wet state.

Atop the bark mulch, add an inch or two of compost. If this is in short supply, add compost plus whatever soil is on hand to reach the final thickness. Or, if the pile will have a few months to compost before planting, you can substitute manure or several inches of easily compostable material for this layer. But if you plan to plant the sheet mulch within a few weeks, a layer of compost will be necessary to act as a seed bed.

The final layer is 2 inches of weed- and seed-free organic matter, such as straw, fine bark, or wood shavings. Besides smothering weeds, this layer gives the project, in landscaper jargon, "that finished look". For planting seeds and starts, push this layer aside to reach the compost/soil layer right below, just as you would with any mulch.

Other Ways of Composting

For the below methods do not use noxious weeds or weeds in seed, do not use plants that sprout freely from root pieces (such as quackgrass or thistles), do not use diseased

plant materials. But this is a great way to turn your fruit and vegetable wastes, grass and leaves, and kitchen scraps into rich garden compost with little work and small spaces, such as a community garden plot. Here are some variations to fit situations where a traditional bin or pile just doesn't fit.

Pit composting Quick and Easy, bury it right in the garden plot This is the simplest way for composting kitchen scraps. Dig a one-foot-deep hole. Chop and mix the food wastes into the soil then cover with at least 8 inches of additional soil. Depending on soil temperature, the supply of microorganisms in the soil and the content of the materials, decomposition will occur in one month to one year. Food waste burial can be done randomly in unused areas of the garden or in an organized system. This method is effective for those who want their decomposing organic matter to be completely out of sight. The deep hole is also a good place to stick those weedy plants you have pulled up. If buried deep enough, the weed seeds will not see the light of day, so they won't resprout. The hole is best used to enrich an area you ultimately want to plant in.

Trench Composting Like Pit but bigger, more, deeper

Best for end-of-season, or when you have a lot of plant matter to incorporate at once, such as after a crop harvest. Clear an area in the plot at least a couple feet wide and as long as needed. Lay a tarp or cardboard along the area to pile soil on as you dig a trench about a foot deep as a "row" in the garden. Fill the trench with all the vines, stems and plants until level with the surface, then mound the original soil back over the top by pulling the tarp or cardboard over it. Water in well. The mound will drop as the plant material decomposes, and the trench will become a rich planting bed next season.

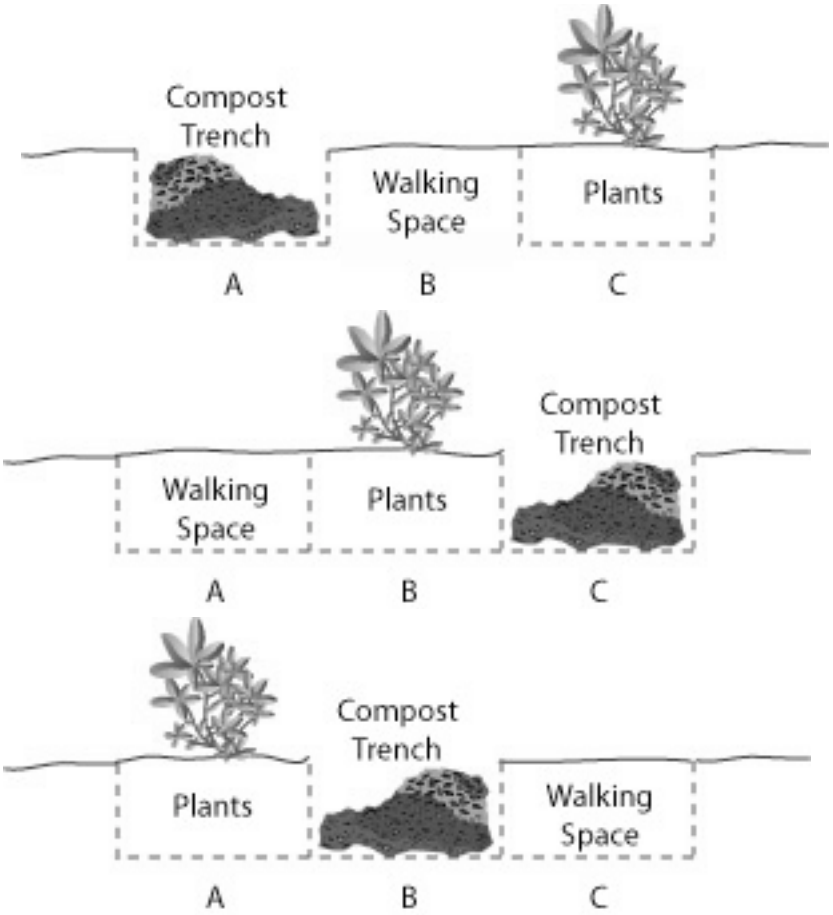
Vertical (English) Composting Like Pit but bigger, more, deeper, organized

This English system, sometimes known as trench or vertical composting, maintains a three season rotation or soil incorporation and growing.

Divide garden space into 3' wide rows.
Year 1 – Dig a 1' foot wide trench on the left 1/3 of the 3' area (A). Add compostable materials in this trench and cover with soil when half full. Leave the center 1' section open for a path (B), and plant your crop in the remaining 1' strip along the right side (C).

Year 2 – Section A is a path for year 2 allowing time for the Materials to break down. Plant your crop in section B. Section C, where you planted last year, becomes the compost trench.

Year 3 – Section A is
now ready for planting. Section B is your trench for



composting. Section C is in the second year of composting is it will be the path.

Cover Crops
Cover crops are planted to build and hold soil and to smother weeds. The roots go deep into the soil, loosening it, drawing up nutrients, hosting soil life, and placing organic matter down further than the deepest plow. Roots are nature's below-ground humus builders. Roots add organic matter in vast quantities during their constant cycles of growth and decay. Plants shed roots hourly and daily, not just in fall when the plants die. Many cover crops send roots fifteen feet deep. No other method could sink organic matter that deep. In choosing cover crops, diversity is again the key. Masanobu Fukuoka, the author of *The One Straw Revolution*, used perennial white clover as a permanent, living mulch in his gardens. To plant crops, he simply opened up small areas in the clover and placed seeds or transplants.

Planting Cover Crops
Work up the soil gently with a garden rake, broadcast seed over the soil, and then rake it in. Raking establishes good soil-to-seed contact and protects the seed from birds. "Birds sometimes eat the seeds if they are **too close to the surface**," says Nancy Creamer, Ph.D., director of the Center for Environmental Farming Systems at North Carolina State University. If you decide to plant cover crops in the fall, be sure to allow them plenty of time to become established. "This means planting them 4 weeks before killing frosts. The one exception is cereal rye, which can be planted right up to a frost," says Marianne Sarrantonio, Ph.D., associate professor of sustainable agriculture at the University of Maine.

Caring for Cover Crops
Cover crops are low-maintenance compared to most crops, but they still need some care. Mowing keeps large cover crops manageable, and sorghum-sudangrass actually increases its root growth if mowed once or twice. White Dutch clover planted in garden pathways needs to be mowed regularly to keep it from competing with vegetables and flowers. Be sure to water cover crops during times of drought.

Timing Your Crop Kill
You must kill your cover crops before they set seed and the topgrowth gets out of control. That's right, kill them. "The best time to kill them is at flowering or when the seedheads emerge on grains. The annuals can all be killed at this point by cutting at the base of the plant," advises Sarrantonio.
You can mow cover crops with a lawn mower or a weed trimmer, depending on how tall the plants are. Wait a day or two until the leaves and stems dry down, and then dig them in. It won't take long before the vegetative growth partially decomposes.
After turning under a cover crop of grasses, wait 2 to 3 weeks before planting vegetables or flowers. The decomposition of the green material can tie up soil nitrogen.

Finding Space in Your Garden
A common concern is the amount of valuable garden space that cover crops occupy. However, you can fit cover crops right into your garden plan.

Succession cropping is one of the easiest ways to do this. After spring crops of lettuce, radishes, and other early vegetables have been harvested, plant a fast-growing cover crop, such as buckwheat. In most climates, you can allow this cover crop to flower and still have time to plant a crop of frost-tolerant vegetables. Cover crops can also be planted in fall after some main-season crops, such as cabbage, are finished.

The Easiest Cover Crops to Grow

Which cover crop is right for you? "You have to keep in mind the time of year and the species you are growing," says Diver. Some, such as cereal rye, are very cold-tolerant and work well for late-season plantings. Others, such as buckwheat, are very frost-tender. The cover crops listed here are widely adapted and can be grown in most areas of the United States, either as a summer or winter cover crop, depending on where you live.

Related: 5 Cover Crops That Will Keep A Small Plot Healthy

Rye

This crop comes in two different types: annual rye and cereal rye. Both have their advantages. Sow cereal rye during the late summer or early fall, and it will grow until late in fall and resume growing in spring. With annual rye, which winterkills in USDA Plant Hardiness Zones 5 and colder, you'll be able to plant your garden earlier, since you won't have to turn the cover crop into the soil and then wait 3 weeks as you would with a perennial cover crop.

Field peas/oats

This dynamic duo combines the benefits of a legume (peas) that fixes nitrogen and a grain (oats) that contributes plenty of organic matter. Both crops are cold-tolerant, which makes this a good mixture to plant in late summer or early fall. In colder climates, they will also winterkill, allowing an early spring start.

Sorghum-sudangrass

As its name suggests, this grass is a cross between sorghum and sudangrass. This hybrid generates large amounts of organic matter and needs little encouragement to grow 5 to 12 feet tall. You can keep this frost-tender plant in check by mowing it down to 6 inches when it reaches a height of 3 feet or by planting it just 7 weeks before frost.

Buckwheat

Buckwheat is a broadleaf plant and an excellent smother crop—it's effective even against weeds like quackgrass. "Buckwheat is very fast-growing and can provide a quick canopy to shade weeds. Just be careful to not let it go to seed, or you'll have buckwheat in your next crop," says Creamer. It matures in just 6 to 8 weeks and can be squeezed in between spring and fall vegetable plantings. Buckwheat's white flowers serve two purposes—they work well as a filler for flower arrangements, and they attract beneficial insects.

Clover

Clover comes in a plethora of different shapes and sizes. White Dutch clover works well as a living mulch, since it tolerates both shade and traffic. Yellow blossom sweet clover is an excellent nutrient scavenger and helps build good soil structure. Crimson clover attracts beneficials and looks great, too. Whatever the color, clover fixes nitrogen and helps to build rich soils. For best results, make sure you inoculate your clover seed with Rhizobium bacteria.

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