

Soil and Bed Preparation

To forget how to dig the earth and to tend the soil is to forget ourselves.

~ Mohandas Gandhi

Introduction to Soil

Soil composition

Soil is made from decomposed rock particles, air, water, living organisms, and organic matter from decomposing plants and animals. Soils differ in the quantities and characteristics of each of these components, but all five are essential for healthy soil.

Soil texture and type

Soil type is generally classified by the size of the broken down rock particles in the soil. Sand has a large particle size, silt has a medium particle size, and clay has a very fine particle size. The proportion of sand, silt and clay particles determines the texture of your soil and affects drainage and nutrient availability.

Soil water-holding capacity

Sandy soils have large particles and a very low water-holding capacity—water drains through them quickly. Clay soils have very fine particles and a very high water holding capacity. Knowing this is important because it tells you something about how often and how much you will need to water your plants.

Soil structure is determined by how individual soil particles aggregate. Good soil structure allows for water, oxygen, and microorganisms to penetrate the soil and that, in turn, increases the amount of nutrients available to plants. Structure can be influenced greatly by management. Consistently adding compost to a soil will improve its structure, increase its water-holding capacity, and make it easier to work in the long run.

Soil testing

A professional soil test provides a wealth of information about your soil, including its type, pH level (relative acidity or alkalinity) and nutrient levels. If you are starting a new garden and have concerns about potential soil toxins, such as lead, in your area, a soil test that screens for common environmental toxins is a good idea.

Keeping garden soils fertile

Soil fertility, in part, determines a soil's capacity to produce. Fertility management should focus on feeding the soil (including the organisms in the soil), so that the soil can feed the plants. Three key methods for feeding the soil are:

- Compost
- Cover crops
- Addition of other amendments

Compost

Compost adds plant nutrients, organic matter and beneficial microbes to the soil. Adding a very thin layer (just more than a sprinkling) of good quality compost can supply most or all of the nutrients needed to maintain soil fertility and healthy plants season after season. Increasing a soil's organic matter content by adding compost can improve soil tilth, allowing for increased water and air penetration. If you are using compost to improve tilth, add about ¼-inch thick over the surface and then mix it in to the soil. This is much more than is required to simply maintain soil nutrient level.

Cover crops

Cover cropping is the practice of planting an area with plants that will cover the soil surface to prevent or reduce erosion and then, once turned back into the soil, will improve soil structure and fertility. This practice has many benefits for the soil, as well as potential benefits for pest management. Cover crops increase soil organic matter, fix atmospheric nitrogen into a form that plants can utilize, improve soil structure and soil-water relations, prevent (or reduce) erosion and nutrient leaching, and compete with weeds.

Cover crops can be chopped into the soil or can be removed and turned into compost. Ideally cover crops are used before they set seed. If you turn them into the soil, expect to wait about three weeks for the cover crops to break down before planting in the bed. Most cover crops are relatively easy to grow and can be interesting, low-maintenance annuals in the school garden.

There are two types of commonly grown cover crops: legumes and grasses.

Easy cover crops for school gardens

	Legumes	Grasses
Winter	vetches bell or fava beans peas berseem clover	oats wheat barley rye
Summer	cowpeas (black eyed peas)	Sudan grass sorghum annual buckwheat oats rye

Preparing soil for planting

Your primary goal is to loosen the soil so that roots, water, and oxygen can easily penetrate the soil environment. Soil that has been prepared well will exhibit a nice "crumb" structure, and will be easy to penetrate with a tool when damp. Secondary goals are to mix in compost or other soil amendments and to build a bed or "plant place" that is distinct from paths or "people places." Making this distinction clear for children can prevent them from compacting the soil or trampling plants in the beds.

Pre-irrigate to prepare the soil

The amount of moisture in your soil before you start digging is the most important factor in determining how effective your work will be. Ideally, it should be about as moist as a wrung out sponge. Why?

- Too little water and the ground will be hard. Clods won't break up easily. The beneficial "crumb" structure of the soil is also fragile when the soil is too dry and can break down into dust if the soil is worked when too dry.
- Too much water and the ground will be heavy. Mud will stick to your implements and you may tire yourself out just moving the weight of water in the soil. The crumb structure of the soil is also fragile under wet conditions and can easily become compacted when worked.

Irrigate areas well at least two days before you plan to work them. Test the soil for the right moisture level by making a ball of soil in your hand. If the soil is wet enough to stick together when squeezed but then dry enough to break apart into small pieces when tapped, you are at the right moisture level for preparing your bed.

Suggested steps for "single digging" a bed

This means loosening the soil one implement depth below the surface. Single digging can be easy and fun, after the first few times your soil is worked and once you have had crops growing in it for a few seasons.

1. Clear all plants and other debris off the bed.
2. Thoroughly wet the bed as described above.
3. Thoroughly loosen the soil using a digging fork or spading fork. If children are helping with bed prep, consider using hand trowels instead of large tools.
4. Rake the surface smooth and level and rake up the edges of the bed so that they are clearly defined.
5. Add compost and any other amendments to the surface.
6. Work in amendments using a hula hoe.
7. Re-rake the surface so that it is flat and smooth and re-rake the edges of the bed.

Other methods of bed preparation for difficult or never-before worked soils

When first putting in garden beds, you may want to consider using a rototiller. While rototilling may not be child-friendly or ideal for your soil in the long run, it can be a great way to get the beds started initially.

You may also consider "double digging," which means loosening the soil two implement depths below the surface of the soil (up to 2 feet deep). This is a lot of work! It is great for a bed when it is first dug, but you do not need to do this every time you prepare the bed. The most effective method of doing this is described and illustrated in John Jeavons, *How to Grow More Vegetables Than You Ever Thought Possible*.

Purchasing soil

If you are starting your garden from scratch and constructing raised beds, soil can be one of your biggest expenses. Soil is usually sold in cubic feet or cubic yard

measurements. If you need large quantities of soil, you can look for a soil company in your area that can deliver to your school site. Delivery of soil will take some coordination as the delivery truck will need direct access to garden, and/or you'll need to move large quantities of soil by hand to the desired place in the garden. Local hardware companies and nurseries sell bags of soil for amending or filling beds in different cubic feet quantities.

Tips for purchasing soil

- Purchase organic soil to ensure that the soil is safe for children to handle.
- Do some research and cost estimates on how much soil you need to fill your raised beds or amend your current soil. You can engage students in measuring the volume of raised beds to see how much soil is needed.
- Be cautious when accepting soil donations from others' yards or other unverified sources. While it could save money, you might be introducing soil infested with weed seeds or chemicals.

Soil Measurements

27 cubic feet = 1 cubic yard

10'x 3'x 1.5' raised bed (10 feet long, 3 feet wide, 1.5 feet high) needs 1.66 yards of soil

Tips for working the soil with kids

- Always discuss, demonstrate, and review safety rules with children before handing tools out. Suggested rules include holding the point down, putting tools away when not in use, and keeping the metal parts below the hips.
- When working with a large group of children or small children, consider using hand trowels instead of large tools to prepare the soil.
- Make sure every student has his/her own job, whether it is adding compost to the soil, breaking up clods, or pulling out stubborn weeds.
- Make sure students are spaced safely apart so they are not interfering with each other's tools.
- When kids are working with tools, refrain from working so that you can keep your eyes on all of them. Enforce the rules consistently, and provide an alternative activity for any student who is not using tools safely.
- Musical Shovels: A fun digging activity is to circle students around the area that needs to be worked and have them turn the soil in front of them while music plays (or is sung by everyone). When the music stops, students rotate to a different position. This is fun, and keeps the soil from being over dug in some spots.