

FROM FARMING TO GARDENING: Bringing Soil Health to Life

Soil is your greatest resource for success. Its health and vitality are essential for healthier food, cleaner water, richer biodiversity and a calmer climate.

Taking care of your soil all comes down to six basic principles, whether on the farm or in a garden.

*These are known as the
6Cs of Soil Health.*

The 1st C: Control Compaction

Soil becomes compacted when downward pressure compresses the soil's structure, reducing or eliminating pore spaces. These spaces are where water and air are held; eliminating them turns soil from a sponge-like material into something more closely resembling a brick. Since both soil organisms and plant roots need water and air to thrive, compacted soils are unhealthy and unproductive. For a farmer, compacted soils, impermeable to rainfall, result in increased flooding, loss of expensive inputs through run-off, and increased surface water pollution.

As a Gardener, it is important to remember to:

Watch where you walk.

The weight – downward pressure – of our walking compresses soil's structure, leaving little room for the underground pathways that roots, water, air and soil critters need to travel.

While soils can easily handle the odd footstep or wheelbarrow rut, repeated walking on soil results in the kind of thing you see with any well-worn forest or meadow pathway – a hard surface that rejects water and plant roots alike.

Here are some ideas on how to control compaction in your garden or your yard.

- **Add compost each year**, in the spring or fall. Compost feeds the critters that consistently work to build your soil's sponge-like structure
- **Disturb the soil as little as possible.** Digging, roto-tilling, turning the soil over – all gradually destroy the lovely sponge structure of your soil.
- **Keep the same pathways year after year** and cover them with wood, bricks, or stone. Or, you can add compost and grass seed in the fall and turn your garden pathways into grass ways. Grass has a huge root system that helps soil resist compaction.
- **Be careful when you add fertilizer (synthetic or organic).** More is not always better. Too much nitrogen, for instance, can attract weeds and reduce organic matter, which leads to compaction. Soil tests are helpful, but so is common sense. Don't over-feed, practice the 6 Cs, and your lawn and plants will thrive.

For more information, visit www.compost.org.



Control Compaction

... one of the 6 C's for
Healthy Soil

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The 2nd C: Cultivate Carefully

Each time the soil is tilled (or dug up), the soil's structure is damaged, breaking up aggregates and disrupting the many intricate networks created by beneficial organisms such as soil fungi. Tillage also introduces more oxygen into the soil, which boosts the activities of decomposer organisms, such as bacteria. This more rapid decomposition is what provides the fertility flush, but it also releases more soil carbon as CO₂, reducing levels of soil organic matter (SOM). As SOM levels drop and routine disturbance continues, microbial diversity also drops, leading to poor soil structure, reduced soil functions, less resilience, and the need for more and more inputs to achieve the same results.

Reduced disturbance allows soil microbial communities to achieve higher levels of diversity and efficiency. Over time, this results in higher soil-health scores for soils that have been managed with less disturbance. Greater soil health means increased soil functions, including fertility, pest and disease suppression, and resilience in the face of climate extremes.

As a gardener, it is important to remember to:

Try to dig as little as possible. It disturbs the structure of our soils.

As gardeners, we have been doing a lot of digging. For example, we have been turning the soil over every spring and have not hesitated to dig and then break up any clumps of soil in order to create a nice even planting bed.

We need to develop better, more careful gardening habits. Let's always remember that soils are living ecosystems, teeming with tiny critters, mostly invisible, who support plant growth and health.

When soil becomes compacted:

- rainfall runs off the surface of your soil, instead of seeping into it, or just forms puddles that later evaporate in the sun
- your helpful underground critters shrivel up and disappear
- you will have to keep adding more and more water, fertilizer and pesticides, just to replace the benefits your workforce would have provided free of charge.

Of course, in most gardens there will need to be some disturbance, such as digging a small hole to plant a seedling. But try to keep any such disturbance to a minimum.

Here are some tips for how to practice **no-dig gardening**.

- **Whatever you do, don't turn the soil over! Disturb the soil as little as possible when you weed, seed, or plant.** In many cases, you can spread seed on the surface then cover with compost or soil to the desired depth. With seedlings, just make a hole big enough for the roots, put the seedling in the hole, then backfill with compost and/or soil.
- **Don't pull your garden weeds**, just cut them off at soil level, then repeat as they grow back; they will eventually run out of energy and die, leaving their roots to enrich the soil.
- **Better yet, use mulches to prevent weed growth:** organic mulches (e.g., compost, straw, cardboard, wood chips) will break down gradually and feed the soil organisms; inorganic mulches (e.g., crushed rock) will not break down, but will still protect the soil (see the 4th C).



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The 3rd C: Continuous Living Plants

Plants use the miracle of photosynthesis to turn the sun's radiant energy into chemical energy in the form of sugars (in general, these are known as photosynthate).

But plants don't save all this chemical energy for themselves; they share up to 40 per cent of their photosynthate with the organisms in the soil. They secrete sugars and other substances made from these sugars into the soil through their roots, helping to feed and grow the microbial populations in the regions of soil surrounding the roots.

This symbiotic relationship between the soil microbes and plant roots is the basis for soil fertility and the fundamental formula for healthy soils and plants. It makes sense, then, for farmers and gardeners to foster and support this relationship by keeping living roots in the soil as much as possible.

As a gardener, it is important to remember to:

Keep continuous living plants in your garden.

Here are some suggestions:

- **The best cover is a growing plant.** Of course, that may not always be possible between plantings, or when your plants are very young and don't cover much area, so check out the options below.
- **You can cover bare soil with plant residues, compost, or organic mulches.** These materials will both protect your soil and feed your critters.
- **You can also use inorganic mulches,** such as stones, crushed rock or brick, or plastic weed-block. These materials don't feed your critters, but they do protect them. These options are often better suited for perennial plants, such as shrubs and trees, than for garden veggies or annual flowers.
- **Some veggie gardeners like to use corrugated cardboard.** You can cover the entire bed, cutting holes where you want to plant seedlings or place seeds. The cardboard protects the soil, keeps weeds at bay, and eventually breaks down and feeds your underground workforce.
- **Don't remove your annual plants in the fall.** If you want to make the garden appear less messy and more attractive, you can cut your plants and leave them on the soil, perhaps mixed with leaves or other organic residues. *Leave the roots in the soil, however: they are feeding your underground workforce!*

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The 4th C: Cover the Soil

Keeping the soil covered at all times is a fundamental principle of soil health management because it helps protect the soil from erosion, conserves moisture, moderates temperature fluctuations, suppresses weed growth, and provides habitat for beneficial organisms.

As a gardener, it is important to remember:

A bare soil is a vulnerable soil. Keep all soil covered, all year round.

Your soil needs to be protected, so that its environment is not too hot, too cold, too wet, or too dry. Your invisible underground workforce will be as productive as possible when you provide them with a safe environment.

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The 5th C: Crop and Animal Diversity

Optimizing diversity is a key principle in building healthy soils because it fosters a rich and resilient ecosystem underground. Diversity contributes to soil health by increasing microbial diversity, enhancing nutrient cycling, improving soil structure, reducing the incidence of soil-borne diseases and increasing resilience to environmental stresses.

As a gardener, it is important to remember:

Diversity is nature's secret weapon.

If you have a lot of different types of plants above ground, you will end up with a greater diversity of friendly critters, both above and below ground. Different plants tend to attract and nurture different types of critters – almost all of them good for your soil and your plants. Why is diversity so important? Here are two important reasons:

First, you want your workforce of helpful critters to include lots of “specialists”. These are critters that are really, really good at specific tasks, such as pollinating your plants (above ground) and protecting them from certain diseases (below ground). The more different types of critters you have in your soil and in your yard, the more likely it will be that your plant can find the help it needs to set fruit on time or to fight off diseases and pests.

Second, you want your workforce to be “resilient”. That means it includes critters that do many of the same good things, but under different conditions. One group might work at high temperatures but go to sleep at lower temperatures. Others will prefer dry conditions, some will like wet conditions. If you have good diversity, there will always be the right critter available for the right set of conditions. That way, both your above ground and below ground workforces are producing great results for you and your plants no matter what the weather brings.

Here are some tips for increasing and maintaining high levels of diversity:

- **Rotate your plantings of annuals.** Rotating your plants breaks up the disease cycle and also brings new types of critters to the area each year, keeping diversity levels high.
- **Use compost.** Well-made, mature compost is full of all sorts of helpful critters. In fact, supporting diversity is perhaps compost's greatest strength. Adding it yearly refreshes the pool of “experts” in your soil, so that your plants have a deep pool of potential partners to draw on whenever the need arises.
- **Have some perennials in your garden.** Perennials feed soil critters all year long, even in winter, which helps to maintain diversity and overall soil health.
- **Use native species.** Native plant species will naturally encourage the development of a community of critters, both above and below ground, that is both diverse and well suited for your lawn and garden environment.
- **Have pollinator-friendly plants in your mix.** They will add to the overall health of your lawn and garden ecosystem, plus add their own underground workforce specialists to the mix.

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The 6th C: Compost and Other Soil Improvers

Compost and other organic amendments play crucial roles in building healthy soils by improving soil structure, fertility, and biological activity. They are rich sources of organic matter, which serves as food for soil organisms and contributes to soil structure. They contain a wide range of essential plant nutrients, including nitrogen, phosphorus, potassium, and micronutrients. They also improve water retention and drainage as well as support a diverse and active soil microbiome, including bacteria, fungi, protozoa, nematodes, and earthworms. These soil organisms play critical roles in nutrient cycling, organic matter decomposition, disease suppression, and soil aggregation.

As a gardener, it is important to remember that:

You can't go wrong with good compost.

We all like to add things to try to improve our gardens and lawns, whether they be fertilizers or various organic soil improvers, such as compost, composted manures, peat moss, etc. But we should be aware that when we add these things we are interfering in a natural system.

Your underground workforce consists of living creatures, with the same physical needs that we have – food, water, air, and a safe habitat. Left to their own devices, as in natural ecosystems, they will build an environment in which they will have all of these things in abundance.

When we interfere in their lives by adding things to the soil, we should do so carefully and consciously. Otherwise, we may well do more harm than good. Here are some tips for nurturing your soil with inputs that help and do not harm your underground workforce.

- **Adding compost is always a good idea.** Compost feeds your soil critters, provides nutrients for your plants, builds organic matter in your soil, and generally helps out around the soil community. But it also has one special feature that other inputs don't have: it adds diversity to your soil. Diversity is good for several reasons (see the 5th C – Create Crop and Plant Diversity) and it can easily be lost. Some inputs can reduce diversity by giving advantages to some critters over others. However, mature compost will never harm your workforce or your plants and will add to soil diversity.
- **If you build a healthy soil, and add compost yearly, you can reduce your fertilizer.** In fact, some very healthy soils don't need any fertilizer at all, just some compost to replace any nutrients removed if you harvest. Your underground workforce will recycle the nutrients in the compost you add, plus get more nutrients out of the minerals in your soil. No extra feeding necessary.
- **Use all fertilizers, both synthetic and organic, carefully and conservatively.** As you build your workforce (using the 6 Cs) to an optimum size and strength, you will need to carefully manage your fertilizer use. This soil-building process may take a few years. During this time, it is very important not to overfeed. A soil test will help, but you need to remember that a soil test only tells you what is in the soil and available to the plants at the time the soil was sampled – it does not tell you how much nutrition your workforce will make available during the course of the season. This additional nutrition can be substantial in a healthy soil. As the natural fertility of your soil increases over time, the amounts of fertilizing inputs can be reduced.
- **Only use pesticides as and if necessary, never as a prevention technique.** As soils get healthier, so do plants. As plants get healthier, they protect themselves from diseases and pests (often working in partnership with your underground workforce). If you have a pest or disease problem, this is an indicator that the health of the soil is less than is needed to fully protect the plants at this time. In these cases, use pesticides if you must, but once the pest has been knocked back, double down on the 6 Cs!

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