The 6 C's for Healthy Soil

Bringing Soil Health to Life

Life all starts with healthy soil. When you pay attention to the health of your soil, you will realize a harvest of many benefits: climate stability, improved water quality, drought resistance, healthier food, and a lush and beautiful environment. It comes down to six basic practices: the 6 Cs of Soil Health.

Practice 1 – Control compaction

Watch where you walk. Use dedicated pathways in gardens (laying down boards, bricks or stones is good) and stay off the growing areas, especially when they are wet! Compacted soil is damaged soil.

Practice 2 – Cultivate carefully

Soils are living ecosystems, teeming with tiny, mostly invisible, critters that support plant growth and health. These critters are your friendly and important underground partners in the work of building healthy soils. Digging, roto-tilling and other forms of major soil disturbance destroy their underground homes and networks. This changes their focus. Instead of helping your plants grow large and healthy, they must spend their energy rebuilding their communities. Be careful -- minimize soil disturbance.

Practice 3 – Continuous living plants

Plants feed soils, just as soils feed plants. Living roots secrete carbon-rich materials (e.g., sugars) into the soil, attracting and feeding multitudes of beneficial soil critters. The larger and more diverse the population of these critters, the healthier the soil and the happier the plants. A soil that contains no live roots is a hungry soil – keep the critters well fed!

Practice 4 – Cover the soil constantly

Our changing climate can be harsh and unpredictable. You never want bare soil, exposed to the elements. Too much or too little water, extreme heat or cold, and high winds can cause a lot of harm. Blanket the soil with mulch, compost, and/or living plants. This will help keep the soil cooler in summer, warmer in winter, and at a good moisture level all of the time.

Practice 5 – Crop and animal diversity

Soils are complex, teeming with different forms of life, all of which work together to keep the soil healthy. Practice diversity (e.g., planting a wide variety of species, rotating vegetable crops) and you will ensure that your soil is resilient and thriving with many forms of beneficial life.

Practice 6 – Compost and other soil improvers

Adding compost to your soil is one of the easiest ways to improve soil health. Compost feeds the soil critters and helps them build better soil structure, deliver important soil nutrients to plant roots, help fight off diseases, and create a generally healthy balanced ecosystem. For you, this means more readily available nutrients and water for your plants, with fewer pests and less disease.

For more information on compost, food-growing and soil health, please visit **www.compost.org**

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The 1st C: Control Compaction

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. The downward pressure eventually collapses the sponge structure built by your critters and makes your soil more like a concrete block.

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.

Control Compaction
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The 2nd C: Cultivate Carefully

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

As gardeners, we have been doing a lot of digging. We have been turning the soil over every spring to manage weeds. We have been digging our compost into our soil. Generally, we have not hesitated to dig and then break up any clumps of soil in order to create a nice even planting bed.

Unfortunately, we have not really been aware of what all this disturbance does to our soils. Each time we dig, we destroy the soil's structure and disrupt the many intricate networks that hold our soils together. Digging also releases carbon stored in the soil (it goes back into the atmosphere as CO_2) and collapses the spaces where the soil critters live.

We now understand that we have to be gentler and more careful when we cultivate our soils. 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.

A frequently disturbed soil is an unhealthy soil. It becomes compacted, with few spaces for air and water and nowhere safe for the critters to live. On the other hand, a healthy soil is like a sponge, full of spaces that can store air and water. These spaces provide safe homes for our underground friends.

So what happens when your 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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Cultivate Carefully

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The 3rd C: Continuous Living Plants

Plants feed soils, just as soils feed plants. Living roots in the soil keep your soil critters well fed and productive.

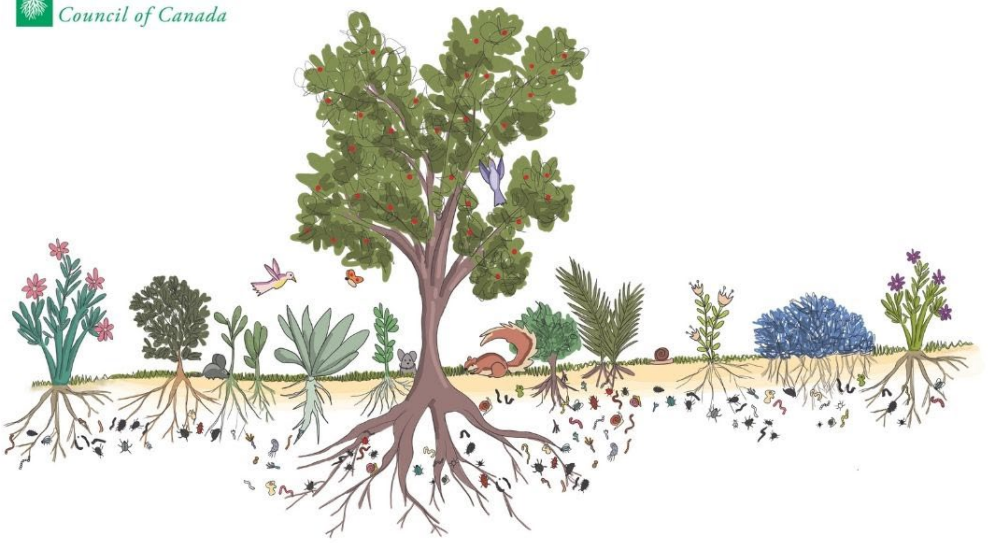
Plants use the miracle of photosynthesis to turn the sun's radiant energy into chemical energy in the form of sugars (in general, known as photosynthate). Each plant uses the energy in these sugars to build its own living tissues and to reproduce via flower and seed.

But plants don't save all this chemical energy for themselves; they share up to 40 per cent of their photosynthate with the critters in the soil. They do this by secreting sugars and other substances made from these sugars into the soil through their roots. They use these secretions (called *exudates* by scientists) to feed and grow the populations of critters in the regions of soil surrounding their roots. This is a mutually beneficial process by which plants feed the soil critters who, in turn, bring them the nutrients that they need, not only to grow and reproduce, but also to build the defences that ward off diseases and pests.

This symbiotic relationship between the soil critters and plant roots is a key to healthy soils and plants. It makes sense, then, for us as gardeners to foster and support this relationship by keeping living roots in the soil as much as possible.

Here are some tips for keeping continuous living plants in your garden.

- **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!*



Continuous Living Plants

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The 4th C: Cover the Soil

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. Here are some tips for shielding your soil.

- **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.
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Cover the soil constantly … one of the 6Cs for Healthy Soil

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The 5th C: Crop and Animal Diversity

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:

F**irst, 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.

Below 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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Crop and animal diversity

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The 6th C: Compost and Other Soil Improvers

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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Compost and Other Soil Improvers

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