Squamish CAN Garden Q&A April 19 2020:
Top Takeaways about Soil and Nutrients

This is a summary of The Living Soil Workshop by Constance Wylie as a part of the Squamish CAN 2020 Garden Workshop series, to get to the bottom of healthy soil. She is an ecological farmer, permaculturist, garden educator, and co-chair of the Squamish Food Policy Council.

Soil is alive, dirt is dead. A single teaspoon of rich garden soil can hold one billion bacteria and several meters of fungal filaments and ten thousand amoebae! The number one priority for gardeners is to look after the soil, it will look after your plants.

Fertilizer containers tend to indicate that getting the right amounts of N-P-K are all there is to growing healthy plants. What even is N-P-K? Nitrogen - Phosphorus - Potassium are three important nutrients for plant growth. But there's a lot more going on.

Instead focus on increasing the amount of life in your soil, by actually feeding all the worms, beetles, millipedes, and all the billions of microscopic bacteria, fungi, protozoa, and nematodes, your plants will have the right nutrients, N-P-K plus all the rest, delivered straight to their roots.

Think of it as fast food (chemical fertilizers) vs. slow food (organic matter) and all the associated health benefits.

Photo - What we see: Worms creating compost-lined tunnels perfect for plant roots, water, and oxygen to pass through. What we don’t see: millions of microorganisms decomposing, shuttling nutrients & contributing to soil structure. Notice the layer of mulch on top of the soil.

In a nutshell

1. **Prioritize soil life**. Healthy soil = healthy plants = healthy humans
2. **Keep your soil covered.** Mulch, mulch, mulch to retain moisture, reduce weeds & increase organic matter.
3. **Minimize soil disturbance**. The Soil Food Web will mix things in and loosen and aerate the soil for you! (see pic 1.)
4. **Organic matter** will solve most of your problems, add compost, add compost, add compost. It's worth paying for good compost.
5. **Moisture**. Plants and soil life need sufficient moisture to thrive

Get to know your soil

Soil is a mix of **inorganic** and **organic** components.

Inorganic components are clay, silt, sand, and minerals. The proportions of these affect your soils ability to hold water and nutrients.

Clay is the smallest particle, is easily compacted, and retains water, often to a gardener's despair. It also holds on to nutrients exceptionally well. **Sand**, the largest particle, is loose with poor moisture and nutrient retention, but important for drainage.

Without the organic living components, clay, silt, sand, and minerals are just dirt.

Organic components are all the living (and once living) organisms. This includes bacteria, fungi, protists, archaea, animals and plants. Each organism fills a niche in the Soil Food Web, breaking down organic matter and delivering nutrients to plant roots.

Visible soil life is a good indicator of invisible soil life. The more worms, millipedes, beetles, etc. you find in your garden, most likely the more invisible soil life there is. The more life, and the more diversity of life, below the soil, the more life and diversity that can be supported above ground.

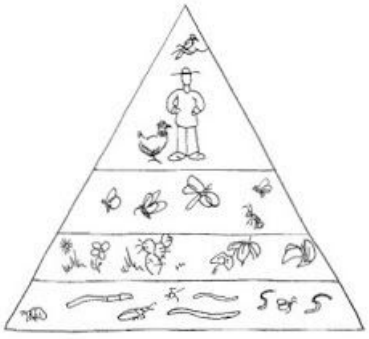


Fig. I.5A. Poor soil supporting a limited amount and diversity of life. Adapted from *Gaia's Garden*, Chelsea Green Publishing, 2001

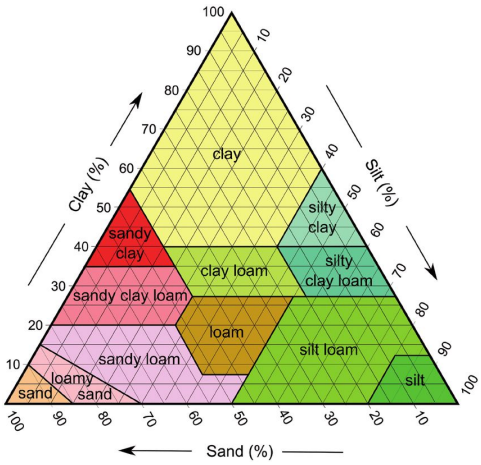
Fig. I.5B. Healthy and diverse soil life supporting a greater amount and diversity of life and resources. Adapted from *Gaia's Garden*, Chelsea Green Publishing, 2001

Soil Assessment:

Observation: You can learn a lot about your soil just through some simple observations. Ask yourself these questions

- What's already growing there? How healthy do the plants look? Different plants can indicate different soil conditions. As soil health improves, the type of weeds can shift.
- How wet or dry is the soil, relative to the weather? Clayey soil stays wetter, sandy soils drain faster, healthy soils rich in organic matter can be in the goldilocks zone .
- Does your soil stick together or fall apart when you squeeze it in your hands?
- What soil life do you see? How much and what variety?

Jar Shake Test: Fill a jar ⅓ soil and top with water, plus a squirt of dish soap. Shake it - five minutes is ideal then allow to settle for 24-48 hours. Layers of the different inorganic materials will form, showing you the composition. Sand on the bottom, silt in the middle, clay on top. You can eyeball or measure the percentages then use the soil triangle to determine your soil type.



Shown here is the garden soil blend from Coast Aggregates in Squamish, looks like a *sandy loam*. The dream is **loam**, but any soil type can be turned into beautiful growing material by increasing organic matter. It's not worth adding sand, silt, or clay to 'improve' your soil.

Soil Testing Know what the problem is before you treat it! Get a laboratory soil test - at home kits don't work - and follow recommendations. When applying nutrient specific fertilizers, think little and often rather than a lot all at once. Find more info on soil testing and a list of BC laboratories here

Organic Matter

Slow Food: Nutrients gradually released to plants as microorganisms decompose
Builds Humus: Different from the chickpea dip hummus. Humus is the end product of decomposed organic matter. It improves soil structure - sandy soil holds water, clayey soil is aerated - retains nutrients and carbon in the soil,and provides a home for microorganisms.

Sources include:

-compost - make your own at home or purchase. It's worth spending the extra money for high quality compost. Cheap bags of compost are often devoid of soil life and low quality.
-dried leaves - collect dried leaves as they fall, use as mulch, add to compost, and save in bags for later use.
-straw - effective mulch
-**plant roots** - leave roots in the ground, they improve soil structure & retain beneficial bacteria!
-**manures** - well rotted manures, especially horse manure are full of nutrients. Be careful with chicken and cow manure which are very high in nitrogen and can burn your plants.
-vermicompost - get a worm bin! Worm castings are exceptional plant food and add beneficial bacteria to the soil
-alfalfa - a deep rooted perennial rich in nutrients and minerals, like a multi-vitamin for your soil and contains a naturally occurring growth hormone, trianconatol. It can be applied in powder and pellet form, or a bale of alfalfa hay can be used, doubling as a mulch

Use compost. Add an annual application of compost, it can be lightly raked in to the soil. Applying in the spring can reduce nutrient leaching due to heavy rains.

The Many Benefits of Mulch - Keep your soil covered!

- Moisture Retention: Mulch helps prevent natural evaporation of moisture from the soil year round. That means less watering!.Your plant will have a lower risk of drought stress, and your soil life will be happy too, they need water to survive.
- Nutrients: Mulch also feeds your soil food web. As soil life breaks down the mulch and which will deliver nutrients to your plants
- Compaction: Rain is a major contributor to soil compaction! Mulch diffuses the impact. The decomposing organic matter improves your soil structure, with the help of healthy soil life.
- Soil Temperature: In the winter, mulch insulates the soil and protects your overwintering vegetables, and regulates soil temperature through the year. BUT In early spring, pull back your mulch to expose the soil to help it warm more quickly, your seeds & new seedlings will thank you. Soil temperature is more important than air temperature for seed germination.

- Seedlings: Pull mulch away from new seedlings, it can harbour pill bugs and slugs who can do irreversible damage to the young plants.
- Weed Suppressant: As a bonus, mulch mimizes weeds!

To Till or Not to Till?

Deep tilling, including shovelling, has the long-term effect of causing *more* soil compaction and loss of soil life and nutrients. It breaks fungal networks that play a very important role in delivering nutrients to our plants, and also turns up buried weed seeds, annoying! While it is tempting to get that clean fluffy soil look from tilling, a healthy soil biome will do the job for you.

Tilling is ok in the first year to break ground for a new garden, but another option to consider is to build up with sheet mulching or lasagna gardening. This layering technique builds soil in place and can be directly planted into.

This picture shows fungal mychoryzae - the white-coating plant roots. Dried plant stems left in place provide a home for beneficial insects over the winter, and their roots contribute to soil structure and add organic matter. Worm tunnels aerate and loosen the soil for plant roots to penetrate.

Adding Nutrients

Watch your plants, they will tell you what they need. Pests and diseases will attack unhealthy, stressed plants. Healthier plants have defenses in place to fight back.

Before jumping to applying fertilizers at the sight of wilt or stunted growth, ask yourself if there are any environmental factors that may be causing your plants to look sad. Are they stressed by drought? Blossom end rot in tomatoes is a sign of calcium deficiency, but not necessarily because of calcium deficient soil! Irregular watering can prevent the plant from uptaking calcium. Wind & temperature can also cause plant stress.

Full-spectrum organic fertilizers, such as fish and seaweed concentrates, can be applied throughout the growing season. These can be found in most garden centres as a liquid concentrate, and are applied by diluting in water. Gaia Green 4-4-4 is another popular option.

Compost Tea is a supercharged mix of microbes and nutrients. To make, soak compost, idealling in some type of permeable sack, in a bucket of water for 24-36 hours. *It must be aerated*! You do not want to encourage growth of anaerobic bacterias - if it gets that stinky anaerobic smell, don't use it in your garden.

Cover crops are used to keep soil covered and fill in unused space in the garden especially over the winter. They can help build better soil, adding nutrients and organic matter.

But, in the small garden, they're not the best use of space. It's easy to maintain fertility with regular top ups of compost and mulch. Sometimes they can do more damage then good - Fall rye will attract click beetles to lay their eggs, their larvae, wireworm, can cause huge damage to root crops.

If you choose to use a cover crop, clover and buckwheat are good options for a small garden. Try seeding between your bigger overwintering vegetables as a "living mulch".

Clover, pictured left, forms a symbiotic relationship with a nitrogen fixing bacteria. If you look closely you can see nodules on the roots where the bacteria lives. With all nitrogen fixers, you *have to leave the roots* in place to decompose for the full benefit of increasing nitrogen (and organic matter!) in your soil. Cut the tops and add them to your compost.