



Soil Health



Chief Seattle, 1854: "we do not inherit the earth from our parents; we borrow it from our children"

This earth includes the soil. Soil is more than just dirt, it is a complex ecosystem, living and breathing beneath our feet for every step we take.

Soil can be damaged in many ways including carelessness and neglect just like other delicate ecosystems such as rainforests can.

Soil health can be improved by considerate gardeners; their approach is to look after the soil and let the soil look after their crops.

Soil As An Ecosystem

Soil has non-living mineral components such as stones, sand, and clay particles. Soil types vary considerably around the world and even from one part of an allotment site to another. Each soil type has advantages and disadvantages for growers; for example, clay soil retains water better than sand but is slower to warm up in spring. Most non-living parts of the soil we have can rarely be changed much, but fortunately, we can improve conditions for plants by attending to the living (organic) components.

Principles Of Soil Health

Allotment gardening lends itself to healthy soil. The principles to follow are:

1. Increase organic matter
2. Cover the soil, so it is not exposed
3. Minimise soil disturbance
4. Reduce pesticide use
5. High plant diversity
6. Avoid compaction by heavy machinery



Minerals

Plants need many different minerals to grow well, and a healthy soil will provide these in balance. Unhealthy soils may lack certain minerals, for example, magnesium deficiency or the minerals may be out of balance. Often the minerals in soil are difficult for plants' roots to absorb; the minerals are insoluble or "locked up". Mycorrhizae can access these minerals and boost plant growth.

Mycorrhizae

Mycorrhizae are beneficial fungi that live in the soil. They associate with plant roots and may superficially look like a disease, but they are doing good. The mycorrhizae access soil minerals that the plants' roots are not able to reach or dissolve on their own. Healthy soil will have plenty of mycorrhizae but if your soil lacks these fungi, you can buy powdered preparations and inoculate your soil.

Nitrogen and Nitrate

Nitrogen is one of the most important minerals for living things. It is needed for DNA and proteins in every cell. Plants get their nitrogen from soil nitrate; nitrate is released by bacteria and fungi as they decompose organic matter. One problem with nitrate is its high solubility in water, so heavy rain will remove it and cause pollution in waterways (leaching). Leaching is a double loss as the soil has lost its most valuable mineral and the river is polluted. Therefore, keeping a healthy level of nitrate is very important.

Organic Matter and Biomass.

Much more on this later, but just to clarify what the word organic means in this context. Soil biomass is anything that is alive or was recently alive. This includes anything rotting and the products of decay. All manner of biomass such as roots, worms, insects, fungi, bacteria and anything you can compost will become soil organic matter sooner or later.

Humus

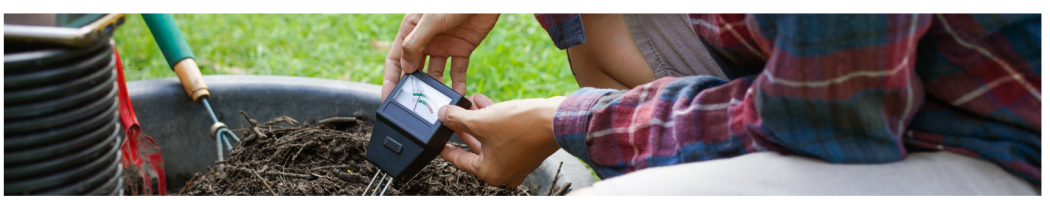
When organic matter is decomposed it becomes humus. Humus is a valuable part of soil. Unhealthy soils have low humus and increasing soil humus improves its condition and productivity. Humus acts like a sponge, absorbing water, storing it in soil and releasing it to plant roots in dry spells. Humus helps soil structure, making clay soils crumblier and more workable and improving water holding capacity in sandy soil.

Oxygen

Healthy soil needs oxygen just like our bodies do. Plant roots need oxygen to respire, as do all the millions of animals, fungi, and most bacteria. Some species of bacteria (anaerobic) can live without oxygen, but these tend to be bad for crops, nutrients, and animals. For example, some anaerobic bacteria remove nitrate from soil, reducing soil fertility. Oxygen is depleted when soil is waterlogged or compacted, for example in puddles. Loose friable soil has plenty of oxygen. Introducing more oxygen into soil by digging or rotavating sounds like a good idea, but can damage the ecosystem and stimulate the loss of soil carbon by release of carbon dioxide, impacting global warming and climate change.

Acidity (pH)

Each type of plant is adapted to a specific range of soil acidity (pH). Some are acid-loving (low pH) and others prefer neutral (pH7). Test kits are available to check your soil's pH. If you try to grow acid-loving plants in soil that is high pH they will struggle; it is easiest to grow plants that are adapted to your soil type. Adding garden lime to soil raises its pH. Often the problems for plants caused by extreme soil pH are indirect. For example acid-loving plants cannot access iron in soil that is high pH; even though there is plenty of iron in the soil, it is insoluble and locked up, inaccessible to plant roots.



Diagnosing - Indicator species

It is possible to get your soil tested chemically, sending samples to a lab at some expense. Another way of diagnosing your soil is to observe the plants that thrive in it naturally, for example the weeds. Nettles are a good indicator of fertile soil, whereas a lot of birdsfoot trefoil and clover show soil that lacks nitrogen. Smartphone Apps that help you identify weed species and an internet search on these plants' preferences will get you a lot of information on your soil's health and nutrient status.

Diagnosing - deficiency symptoms

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Improving Soil Health- Remedies

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Diagnosing - deficiency symptoms

Crop plants with yellow, pale leaves, stunted growth, a purple tinge to leaves and similar are symptoms of mineral deficiencies in the soil. As there are so many different soil minerals, it takes years of experience and training to become an expert at diagnosing each one. Thanks to the internet, a search for images of "plant mineral deficiency" will give you a shortcut in a few seconds.

What Type Of Mulch?

Most sources recommend composting. The compost can be home-made from your garden compost bin or bought from municipal composting of green waste, or even bought from garden centres. Many forms of mulch have been used successfully, including straw, shredded garden, or tree prunings, grass clippings, manure, weeds that have been pulled out or any other available organic matter. Any amount of mulch is good, but more is better. Aim for a layer of mulch that is several inches (10cm) thick. Even thicker is fine if you have a good supply.

When To Add Mulch?

Mulch can be added at any time of year. If mulch is added in autumn and winter after the previous crops were harvested, then a layer of cardboard can be placed on soil first with the mulch on top. The card suppresses weeds and soon rots down along with the mulch. In summer, once crops are established and have grown 10cm high, then mulch can be added between rows. If pot-grown seedlings are being planted, then mulch between plants. Any patch of ground that is not currently being cultivated can be mulched between crops to improve the soil and prepare for the next planting.

Pests And Diseases

Some pests and diseases leave spores in the soil for many years, for example onion white rot. Using pesticides is likely to harm many other species and damage soil health. The best way to minimise such pests and diseases is crop rotation and hygienic removal of any infected material from the allotment.

Green Manures

Green manures are crops grown specifically to improve the soil. They are not harvested but are composted to increase soil organic matter. The green manure crop covers the soil whilst it is growing, protecting it from wind and rain erosion and leaching. Some green manures increase soil nitrogen, for example peas and beans, so "fertilise" the soil ready for the next crop.

Minimises Soil Disturbance

Digging and rotavating can damage the soil ecosystem, but fortunately, there is a better way of gardening that requires less effort. No-dig gardening works with the soil by adding mulch to it and between crops. The mulch suppresses weeds, conserves soil moisture but allows rain through and feeds the worms who do the digging for you. If you are new to no-dig gardening it is probably best to try it on a patch or a bed for a season.

More Information On No Dig:

[Charles Dowding is a leading voice of the No Dig m The Soil Association.](#)

