

SOIL, THE CINDERELLA SUPERPOWER!

As the UK looks to find ways to combat climate change, the status of humble soil is changing. You may have thought, particularly whilst trudging through the mud this past wet winter, there was rather too much of it and in the wrong places. At least a bucket full under every car! However, soil can store three times more carbon than is present in the atmosphere and twice the amount in trees and forests so maybe it is due a bit more consideration.

Soil structure is a key characteristic of good growing conditions. When it is maintained by good husbandry there is ample drainage between the aggregates but also plenty of plant-available capillary water. Air circulation necessary for essential biological activity is sufficient and there is space for the vast array of organisms that manage our soil to live. Good soil structure withstands torrential rain, droughts, moderate compaction and hard frosts. Water and nutrient retention is high and life in and on it thrives.

By contrast, poor soil structure results in a lack of water retention and collapses under the above mentioned environmental and manmade pressures. Little life is in it, and the serious reduction in fertility drives the ever-increasing use of chemical fertilizers and reliance on pesticides. It takes thousands of years to produce a modest inch of fertile topsoil, yet every year in the UK, 3 million tonnes is lost through erosion and ends up blocking our drains, silting up rivers and polluting our water supplies before ending up in the ocean and causing yet more problems. The message to take from this is that soil needs to be respected, yet kept in its place!

So, what lives in this underrated ground beneath our feet and why is it vital to good soil health. Astonishingly, between a third and a half of this living mass is composed of the network of threads (mycelia) of mycorrhizal fungi which grow in intimate contact with plant roots. Plants pack up light and carbon dioxide into sugars and lipids while soil fungi unpack nutrients bound up in minerals and decomposing material. Historically, one of the biggest limits to plant growth was a scarcity of the nutrient phosphorus. One of the things fungi do best is mine phosphorus from the soil and donate it to plants in exchange for the carbon products they cannot produce for themselves. Fertilised plants grow more and draw down more carbon dioxide from the atmosphere. The more plants live, the more plants die and the more carbon is buried in soils and sediments. The more carbon that is buried, the less there is in the atmosphere. This simple process allowed the explosion of life on earth during the Carboniferous period some 350 million years ago and resulted in such high levels of carbon sequestration that the resulting coal beds fuelled our Industrial Revolution.

However, times have changed! We are now in the situation where we bypass all that fungal effort and mine the phosphate ourselves by mechanical means and apply it in soluble form to artificially increase soil fertility. Phosphates not only derive from artificial fertilisers but are often an ingredient of detergents, domestic, industrial and agricultural. The inability to adequately treat phosphate runoff is at the root cause of current planning legislation. There are many ways to help mitigate the problem: using conservation drainage practices, ensuring year-round ground cover, planting field buffers to help absorb nutrients and implementing conservation tillage are just a few.

Competing with fungi to populate our soils there are a vast array of microorganisms. One modest teaspoon of healthy soil contains more organisms than the world human population! These include bacteria, nematodes, mites, springtails, beetles, spiders and earthworms all going about their daily activities aerating the soil as they perform an unglamorous but vital job of recycling dead organic material. The value of worms at least is generally recognised. The fine paste they excrete because of their mixed diet of compost, fallen leaves, bodies of small animals and fungal material is, in some species, deposited as a cast on the surface. Fresh casts are up to eleven times richer in vital plant nutrients than the surrounding soil. There are about twenty-six different UK species of worms and if you are interested, OPAL at Imperial College London have a useful website and provide a simple protocol for counting worms along with an identification guide for the common species. Gardens can be eco hotspots for worms but arable farmland less so where numbers have declined over the past fifty years. Some arable crops in the UK are routinely treated with about twenty different pesticides per year, including insecticides, fungicides, molluscicides and herbicides. We have no idea what chronic exposure to this barrage of chemicals does to worm populations.

If you are lucky enough to own your own patch of soil you might like to boost its health and its capacity to remove carbon from the atmosphere by following a few simple rules:

As far as possible keep it covered at all times. Bare soil gets hammered by the rain, nutrients are washed out and at worse, it may end up in someone else's garden or down the drain. After crops have been harvested always apply a protective mulch such as fine bark chippings or garden compost.

Avoid compaction by minimising contact with heavy feet or machinery.

Regularly feed your microorganisms with suitable organic material to keep them busy. Synthetic fertilizers kill off most or all soil food web microbes as does excessive soil disturbance.

And, finally, think about converting to No-Dig gardening for your back and the planet!