Compost is dead and decaying plant material. Living plants are a mixture of complex carbohydrates – especially cellulose - and lignin, proteins, sugars and small amounts of many other things. When plants die, cell structures collapse, releasing their contents. The sugars and proteins are quickly taken up by bacteria, and then some of the carbohydrates are broken down into sugars, to be used by the bacteria for energy. Only certain bacteria can digest cellulose and only certain fungi can digest lignin.

The process of decay happens quickly with fresh plant material piled up, as the cells walls collapse releasing the more easily digestible material. This is when a compost heap can generate heat – when the easily digested materials are abundant, bacteria rapidly multiply, especially those adapted to thrive at higher temperatures. Once these easily digested materials are used up, the heap will cool down and the decay process will slow down. The cellulose-eating bacteria will be munching away, while the lignin-eating fungus accumulates and begins the slow process of tearing apart tough old lignin. Lignin can take years to digest.

Not all the microbes eating the plant material are free roaming individuals. Some are captive within the digestive systems of larger animals – woodlice, worms, beetles and so on. These creatures contain collections of microbes within their digestive system. They’re doing the same job as the free roaming microbes, but making a living out of hosting their own collection of microbes and doing the roaming and hunting for them.

In the end, it’s all the same process – big molecules being broken down bit by bit into smaller parts. Eventually, the great majority of a plant is broken down into water, carbon dioxide, and ammonia, and smaller quantities of sulphur-based materials and minerals.

Which is basically plant food. These are the materials a living plant needs to absorb to grow.

The bacteria and fungi get their energy to live from the decomposition of the big molecules in dead plant material. Living plants get their energy from the sun, and use it to assemble the smaller molecules released by decomposition back into the substance of living plants. What goes around comes around.

Soil is a mixture of mineral particles – clay and sand, organic matter such as dead plant materials, water and air. Usually in these sorts of proportions – 45% mineral, 5% organic matter, 25% water, 25% air.

That 5% organic matter is important. It’s the smallest proportion, but if it wasn’t there, your soil would be almost entirely mineral – clay if the particles are small, sand if the particles are large. And it would be almost useless at supporting plant life. The presence of the organic matter gives the soil a complex structure which opens up the soil, creating the space for air pockets and for moisture to permeate the soil.

The organic matter isn’t static – it is constantly decaying just like in a compost heap, being broken down into smaller simpler molecules by the bacteria and fungi in the soil. The carbon dioxide released by the decay is taken up by plant leaves, to be used in photosynthesis. And the nitrogen and sulphur and other minerals released is absorbed by the roots of the plant to be reconstituted into living plant material once again.

Generally, the decaying organic matter in the soil is replaced by fresh dead plant material landing on top of the soil.

Notice, there are two major roles of the organic matter in the soil. One, is the creation of the open soil structure, allowing water and air to flow within it. And the second role is in the plant food provided by the decomposition of the organic material.

So, adding compost to our garden soil improves the structure of the soil making it lighter and spongier. I saw that myself. When we first started working on our own garden, the soil was simple clay and not much else. A hot dry summer would make it almost impenetrable without a pickaxe. After years of adding compost to our beds, the soil is now much looser. Even in a dry spell in summer, there’s no difficulty shoving most of my hand into the soil.

What I had expected too was that my soil would also be much more fertile. It’s true the fertility was increased, but the growth of my plants – I grow vegetables and run a small tree nursery – wasn’t anything to get excited about.