



SOIL HEALTH management in avocados

The latest buzzword on the block is soil health and regenerative farming. What is meant by these words and where does avocado farming fit into this new “hype”?

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A good definition of soil health would be something like a soil that has enough carbon to sustain a wide variety of micro-organisms (i.e. bacteria, fungi, nematodes, protozoa etc). This, however, does not really describe soil health in its total entity and I would rather use the term *functional soil* as described by Prof Karin Jacobs from Stellenbosch University in an article in *Landbouweekblad*. Her definition of functional soil is a soil that has the ability to function as a **living ecosystem** that sustains plants,

animals and humans.

Where the first definition is not totally wrong, it does not describe what that soil should be able to do, and that is to act as a living ecosystem. To be able to create such a soil it is important to understand the components of such a soil. There are three factors involved: soil structure, soil chemical composition and a diversity of active micro-organisms. Let us examine these three factors.

Soil structure (physical characteristics)

Soil structure creates the environment in which plants and micro-organisms

can develop and grow. This means that enough oxygen and water can be retained to ensure healthy growth. It also means that good drainage must be available to create this balance. It will create enough space for nutrient storage that is important to sustain plant growth and it will allow for movement of roots and micro-organisms through the rhizosphere.

Soil chemical composition

This contains all the different nutrients in that soil that sustain life. However, in modern agriculture this also means quite often a lot of toxic elements (Cu, Ni, Al, Co etc.) which, in the right balance with the rest, are not harmful. These toxic nutrients (also referred to as heavy metals) can very quickly upset the diversity and activity of micro-organisms as well as the crops we grow.

A well-balanced soil will have most of the elements in available quantities which the plant can take up. In Figure 1 it is shown how pH of a soil can cause elements to shift from available to less available, while in Figure 2 the interaction between several elements can be seen.

Micro-organisms

Good activity of micro-organisms in soils will create a very good interphase between the soil and soil solution and the root system of the crop. This is a very important interphase and needs to be nourished as much as possible. This will only happen if the plants are

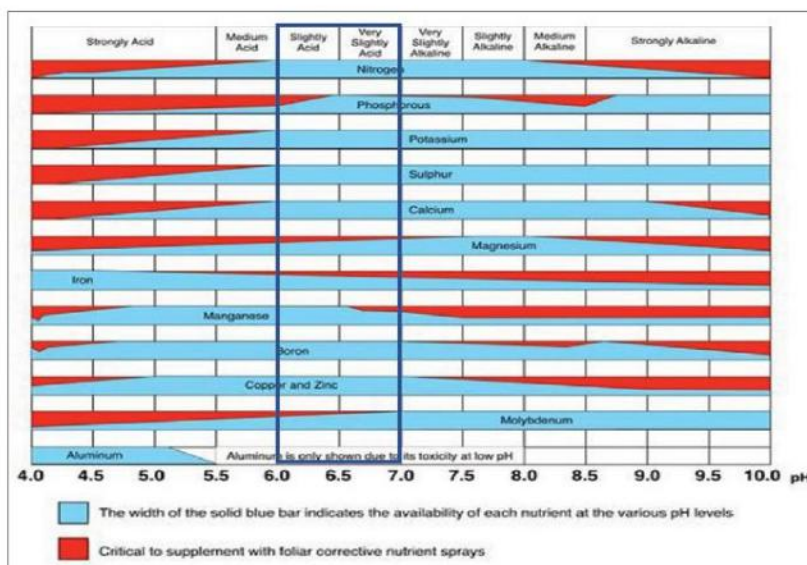


Figure 1. The effect of pH on the availability of several nutrients to plants. The rectangle shows the pH range where most nutrients are readily available.

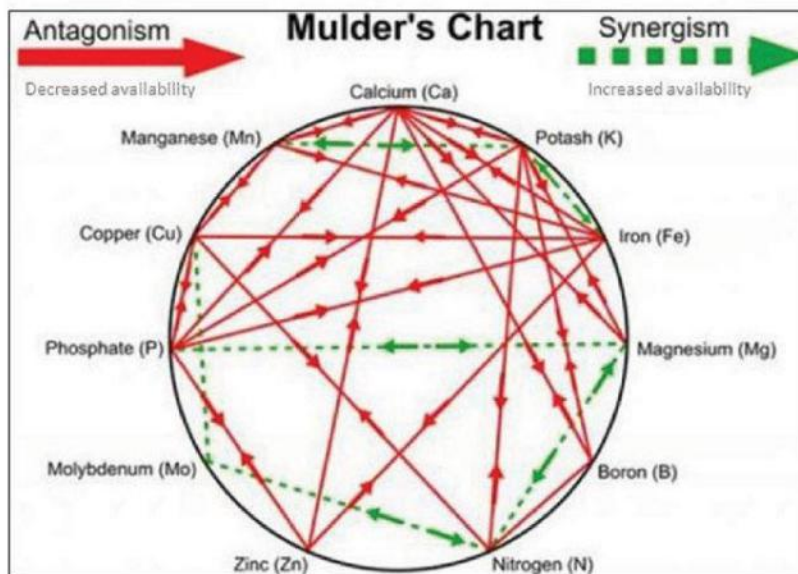


Figure 2. The interaction between several nutrients.

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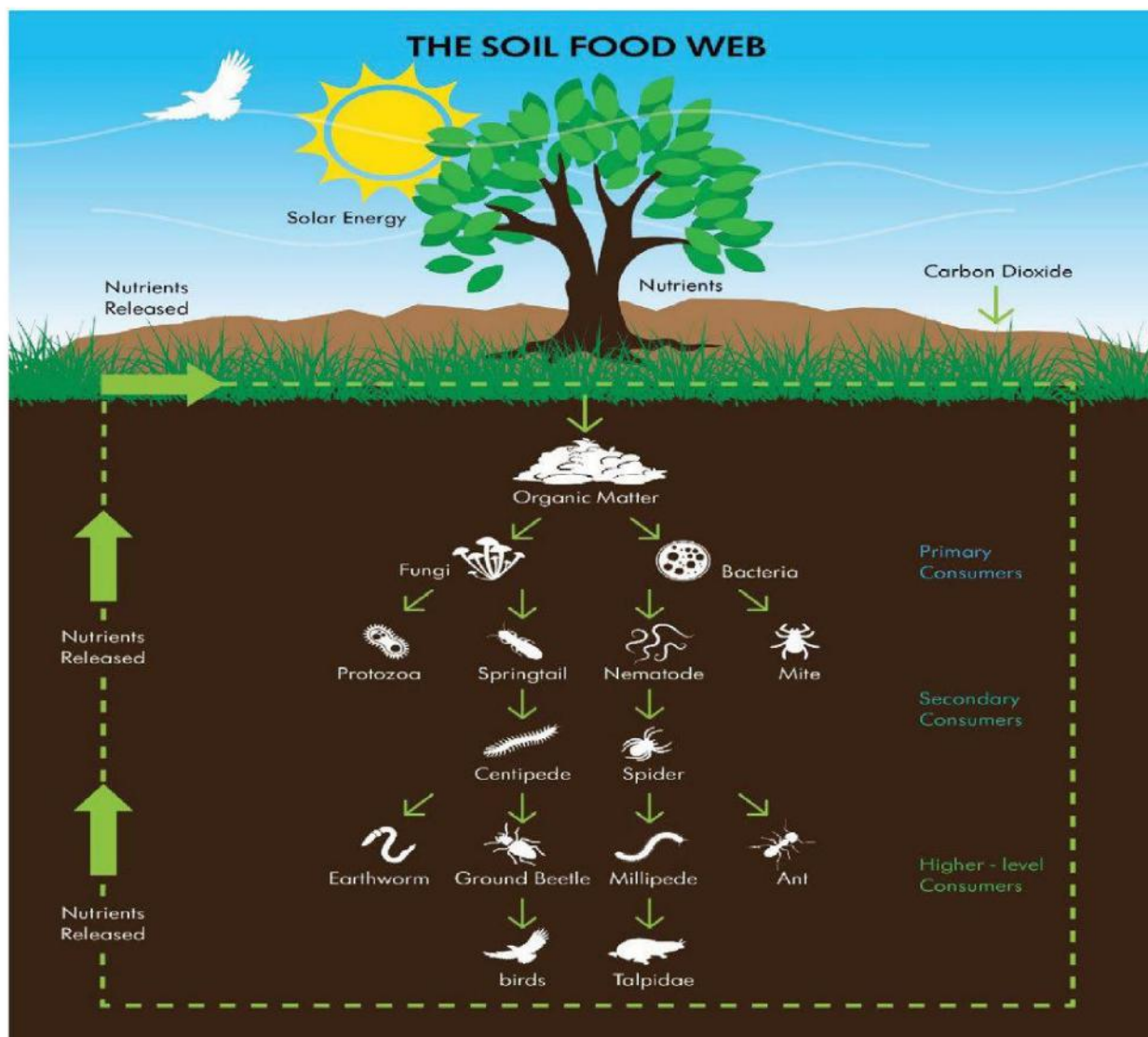


Figure 3. The soil food web as described by Elaine Ingham in detail.

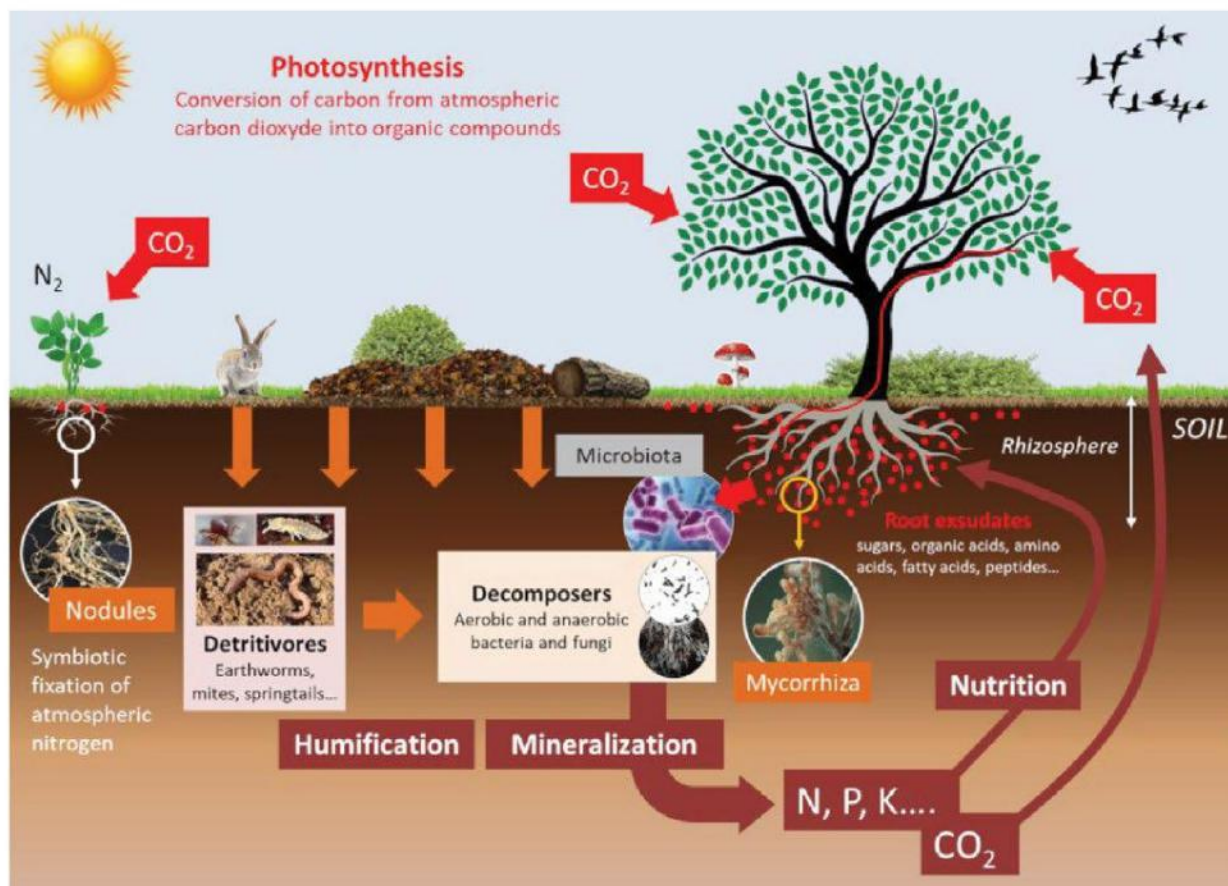


Figure 4. The different nutrient cycles as this happens in the soil-plant-environment continuum.

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To maintain and manage this equilibrium, it is important to observe cultural practices in orchards. The fertiliser we use, the way we handle irrigation and the use of pesticides, fungicides and herbicides will all determine the health of the soil. The use of cover crops and mulches will also have a positive effect on soil health.

Inorganic fertilisers can have a negative effect on the micro-organisms in that they have a salt index that damages a lot of the smaller micro-organisms. This will lower their numbers, giving the negative types a chance to multiply. It would be better to rather use semi-organic fertilisers with a much lower salt index. When inorganic fertilisers are used, apply small doses rather than infrequent large doses.

It is also possible to lower the salt index by using fulvic acids together with inorganic fertiliser as they form a sort of complex, together lowering the risk of damaging the micro-organisms and at the same time supplying carbon to the soil as well.

Irrigation management will improve the availability of oxygen in the soil. If less water is applied more frequently, then the oxygen limited period is smaller and excess water can drain easily away, leaving oxygen available to the micro-organism and the roots of our crops. Most disease pathogens love an oxygen poor environment and will thrive under these conditions while the root systems will start dying of oxygen

deficiency. Use all tools available to ensure that the moisture content is maintained without putting stress on the plants and micro-organisms

Weed control as well as pest and disease control products can contaminate soils or have a negative effect on good micro-organisms, creating space for bad ones. Use herbicides sensibly and remember that a diversity of different root systems will create a healthy environment for microbes. Also, when using chemicals to control pests and disease, use the right coverage spray instead of drenching a tree with chemical mixes as the excess will end up in the soil.

Planting cover crops is good practice as it will create a diverse root environment in the soil. The biomass that is grown above ground can be used for mulching material. The detail of cover cropping is a topic of another article.

What is the way forward? Change your mindset for a new way of looking at soil and how to manage it. Start with small changes in practices, i.e. use fulvic acid when fertilising the crop, or use semi-organic and organic materials as a source of nutrients instead of inorganic fertilisers.

Look at a way to manage weeds in orchards. Rather do mechanical management, use mulches like wood chips to manage weeds and use herbicides only toward the end of the season.

Another very important aspect is to measure what you are doing. There are a few laboratories in South Africa that can test the functionality of the soil. If this is performed annually around the same time, there should be a positive change in the soil, which in turn will slowly but surely increase tree health. 🌱