



Earthworms in a healthy soil

The benefits of healthy soil

Promoting cost savings and protection from disease

Soil health" is the current buzzword in agriculture and biodiversity circles. While many people understand this as encompassing a new concept, others feel that it is muddying the waters with another term for an existing concept, namely 'soil quality'. Soil quality is a perfectly good term that is already well defined and understood. So what is soil health and how is it different from soil quality? Let us consider the two most commonly accepted definitions:

Soil quality: The capacity of a specific kind of soil to function, within natural or managed ecosystem boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation (Karlen et al., 1997).

Soil health: The capacity of soil to function as a living system, with ecosystem and land use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health. Healthy soils maintain a diverse

community of soil organisms that help to control plant diseases, insect and weed pests; form beneficial symbiotic associations with plant roots; recycle essential plant nutrients; improve soil structure with positive repercussions for soil water and nutrient holding capacity; and ultimately improve crop production (FAO, 2008).

Clearly there seems to be very little distinction between soil quality and soil health. Indeed, many people use the terms interchangeably.

But there does seem to be an emphasis on the living component in the soil under the soil health definition.

This is important if it makes people more aware of the biological ecosystem services that the soil can provide, and if it results in more sustainable management systems. Traditionally, soil quality was evaluated by means of chemical status of the soil, and chemical fertilizer was used to correct any shortfalls of macro-nutrients.

However, the focus is shifting from a chemical based management system as farmers become more aware of the benefits of

conserving soil organic matter and use the soil biota to their advantage.

The following are some of the services that the living component of the soil can provide:

- **Soil organic matter (SOM):** This is the basis of healthy soils and improves soil chemical, physical and biological properties. It cushions the soil against compaction, improves water holding capacity, and provide nutrients for plants and micro-organisms. Most importantly it is the start of the food chain in the soil ecosystem, supporting all life in the soil.
- **Soil meso- and macro-fauna:** This group includes nematodes, mites, springtails, earthworms, termites and other animals that are part of the soil ecosystem. They assist in breaking down SOM and contribute to nutrient cycling and aerating the soil.
- **Micro-organisms:** This is the most abundant and diverse group in the soil and includes algae, bacteria, fungi, yeast, myxomycetes and actinomycetes. They facilitate SOM decomposition and regulate nutrient availability in the soil.

Soil biota form an integral part of soil health which contributes to crop production and the sustainable use of agricultural soils. By making use of the services of the soil ecosystem, one can optimize productively and reduce costs.

That is the theory and indeed many farmers are successfully applying these concepts.

For example, earthworms have been credited with incorporating surface applied lime into the soil profile – something that is commonly thought to be only achieved by ploughing. Costs are thus saved in terms of fuel and unnecessary traffic that can cause compaction is avoided.

Mycorrhizal fungi can provide services such as improved phosphorus utilization, while crop specific bacteria can increase nodule formation, and thus nitrogen fixation, in legume crops.

Certain bacteria, such as bacillus, can excrete antibiotics that can protect plants from diseases, while others can stimulate root growth.

Healthy soils support a healthy ecosystem, with plenty of food (SOM), decomposers, predators and carnivores.

In order to maintain a healthy soil one must therefore take care of the soil biota.

This can be done by adopting farming methods that conserve SOM, meso- and macro-fauna and micro-organisms.

These include management practices such as reduced or zero-tillage, permanent soil cover, multi-cropping (such as crop rotation or intercropping), permaculture, companion cropping, and the use of green manure and organic fertilizers. The Agricultural Research Council (ARC) has several projects focusing on soil health. These include studying the dynamics of SOM in agricultural soils; research on conservation agriculture and the effect of farming practices on SOM; as well as demonstration and training initiatives across South Africa.

References

FAO. 2008. *An international technical workshop investing in sustainable crop intensification:*

The case for improving soil health. Integrated Crop Management Vol. 6-2008. Food and Agriculture Organization of the United Nations, Rome: 22-24 July 2008.

Karlen DL, Mausbach MJ, Doran JW, Cline RG, Harris RF, Schuman GE. 1997. *Soil quality: a concept, definition, and framework for evaluation. Soil Science Society of American Journal 61: 4-10.*

Ms Corrie Swanepoel
Soil Science Researcher
ARC-Institute for Soil, Climate and Water
Tel: 076 618 0605
E-mail: swanepoelc@arc.agric.za



Grazing vetch intercrop provides a thick, effective soil cover that protects the soil, conserves water, fixes nitrogen and contributes to the soil ecosystem. Intercropping with grazing vetch significantly improves soil health and subsequently maize yield

Multi-cropping, especially with a legume cover-crop such as cowpeas, can provide soil organic matter, improve the nutrient status and protect the soil



Reduced tillage helps conserve organic matter as a mulch

