

Soil and cattle health: Is there an association?

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Crop producers in general understand the value of soil that is healthy (soil biology), and the last decade or two has seen numerous producers starting to apply regenerative farming principles. Crop farming methods that improve soil biology are well-known.

Production per hectare, for instance maize and sorghum, at the end of the growing season is measurable and the financial income per hectare, in profit in hand, can be calculated. Cash crop producers who apply regenerative agriculture principles can compare their profits to that of the more conventional methods, especially where the different methods are compared in the same district or on the same farm.

Principles of soil health improvement

Producers who strive to improve the health of their soil, or soil biology, know what to do to improve it. The following five principles are acknowledged as very important: minimise soil disturbance; maximise plant diversity; keep the soil covered; maintain living roots all year round; and integrate livestock.

Although the use of livestock is one of the five principles acknowledged as vital in crop farming, the other four can also be applied to improve pastures (natural veld and cultivated grazing) and the health of the soil underneath.

This article attempts to provide practical answers to the following questions or points:

- What is soil health, or soil biology, and why must we care about it?

- How is healthy soil supposed to function?
- What is soil biology and why is it important?
- Does healthy soil have any indirect benefits for the livestock producer?
- Is healthy soil of any benefit to livestock that consume the grass or plants growing in biologically healthy soil and, if so, how does it affect animal health?
- Are there any similarities between the gastrointestinal functioning of ruminants and soil biology?
- How can we monitor the value of soil and animal health in extensive grazing systems (veld grazing)?

Why should we care?

A simple description of soil health is the capacity of the soil to function. The five main functions of soil are maintaining biodiversity and productivity, partitioning water and solute flow, filtering and buffering, nutrient and water cycling, and structural support. A healthy soil is one that is dynamic and alive, and allows the plants that grow in it to flourish as well.

There are three main classes of soil properties, namely physical, chemical, and biological. The physical and chemical properties of soil are fairly well understood, and relatively easy to evaluate and test in a laboratory. It is the biological properties of soil that remain the least understood, yet have the greatest potential to improve soil function and increase plant productivity.

It is therefore obvious to say that if the soil is biologically 'unhealthy', or not performing all of its functions as it is supposed to do when healthy, then the

rest of the environment, including the plants, water and animals, will be negatively influenced.

How should healthy soil function?

Healthy soil must be alive, and should look, smell, feel, and function as such. Observations of healthy soil should reveal a dark colour from organic matter, soil-associated micro-organisms, invertebrates (e.g. insects and earthworms) and vertebrates. Healthy soil should smell slightly sweet with a distinct aroma of geosmin, and should perform the basic roles of water cycling, nutrient cycling, and physical support.

Importance of soil biology

Healthy soil is home to a large proportion of the world's biodiversity. Soil biology is the study of soil micro-organism ecology and their activities, and all the other organisms that spend a significant portion of their life cycle within the soil, or at the soil-litter interface. These organisms include micro-organisms and invertebrates, as well as some soil-loving vertebrates.

Soil biology plays an essential role in determining many soil characteristics. The decomposition of organic matter by soil organisms has an immense influence on soil fertility, plant growth, soil structure, and carbon storage. Unfortunately, the direct and indirect links between soil organisms and soil functions are complex, and the interconnectedness and complexity of this soil food web means any appraisal of soil function must seriously consider the living communities that exist within the soil.



Soil organisms break down organic matter, making nutrients available for uptake by plants and other organisms. Without the biodegrading activities of soil organisms, organic materials would accumulate and litter the soil surface without becoming 'food' for plants. Nutrients stored in the bodies of soil organisms prevent nutrient loss by leaching. Soil organisms also play essential roles in the different intra-soil and other soil-associated cycles.

Microbial exudates act to maintain soil structure, while larger invertebrates (e.g. earthworms, termites and dung beetles) play important roles in soil bioturbation (disturbance or reworking of soil by animals due to burrowing, ingestion and defecation).

The discovery of glomalin in 1995 indicates that we lack the knowledge to correctly explain some of the most basic questions regarding soil biology.

Benefits to man and beast

Indirect effects of healthy soil for the livestock producer are soil carbon

sequestration, improved water storage capacity or more moisture in the soil, prevention of soil erosion, and other ecosystem services.

For any livestock producer interested in optimal veld management, i.e. healthy soil, the most important question is: Is there any benefit for livestock if they consume grass that grow in biologically healthy soil?


Direct benefits from biologically healthy soil are higher biomass production of grass (kg)/ha and therefore also a higher production of beef (kg)/ha, and an increase in macro- and trace mineral bioavailability, which may improve livestock health and productivity.

So are there any similarities between the gastrointestinal functioning of ruminants and soil biology? Yes, ruminal function and the intra-ruminal micro-organism activity are comparable to the functions and activities of soil micro-organisms.

Soil health and ruminant health monitoring are both very important and ongoing activities. In most well-managed livestock herds, the animal health focus is most often well attended to.

However, monitoring of soil, plant, and animal health together is often not given any attention. A more holistic approach to farm monitoring and livestock management is clearly more meaningful and preferable in a modern approach to farming.

Conclusions

Healthy and biologically active soil will not guarantee 100% healthy and productive cattle, seeing as numerous other factors (e.g. management, infectious and parasitic diseases, nutrition, water quality, geology, breed, etc.) may also influence the health and productivity of cattle. However, healthy soil may play an important contributing role if more profitable cattle farming, and in synchronisation with nature, is the ultimate goal. 

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