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REVIEW ARTICLE

Soil Quality and Soil Health: A mini-review

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ABSTRACT

As a living system, soil health and quality sustain not just the soil's biological products, but also the environment and human health. Soil health is the concept of a healthy environment based on interactions between plant inputs and soil. Negative effects on soil health, soil pollutants, and soil loss strategies are becoming rare in growing countries. This study will examine methods to improve soil health practices and data security while reducing negative implications on agricultural output and long-term sustainability.

Keywords: Soil Health, Quality, Productivity, Environment.

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INTRODUCTION

Soil health allows the soil to function as a finite, non-renewable, and dynamic living resource. The term was first used by the Soil Science Society of America Ad Hoc Committee on Soil Quality (S-581) and chewed over by Karlen et al. in the early 1990s (Doran Safely, 1997; Wienhold et al., 2004). Soil, like air and water, is a vital natural resource that supports a wide range of environmental products and services. Environmental preservation and refinement (e.g. water purification, carbon sequestration, pathogen population manipulation, nitrogen fixation, and biodiversity conservation) were only known in the neoteric past.

The scenario for improving soil quality evolves through time for soil and water. Soil processes were such that the earth was considered the domain's environment rather than a part of it. At the same time, the canons, indicators, and requirements for pleasant air and water quality are universally accepted. Soil quality, which is a concept related to soil health, is evolving, with soil quality regulations in some nations being successful up to this point

(Filip, 2002, Nortcliff, 2002). A primary task for sustainable asset use in developing countries is to protect soil quality in the face of changing land usage and rapid economic growth (Doran et al., 1996b). Smallholder supervision intervenes in the fundamental assessment of soil quality and soil health, which is required to assess degradation and convert exclusive land use (Lal and Stewart, 1995). Due to nutrient defects in the soil, over fertilization, loss algorithms, and soil pollution, detrimental implications for soil health and soil quality are developing in the mysterious East (Zhang et al., 1996; Hedlund et al., 2003). Three farming regions in Africa are critically deteriorating (Eswaran et al., 1997). As a result, Africa can no longer provide good meals at the same rate as demand, and food production per unit of population is declining (Lal et al., 1997; Lal, 1998), owing in large part to a lack of soil health and soil quality. In this review, the goal is to see if we can find new offers for soil health, as well as small farmers who are satisfied with their land's quality and soil health, and who ask for help from small farmers living in the tropical areas. This is because these areas are the places where soil quality loss is most likely to have a long-term effect on the sustainability and productivity of damaging collisions.

SIGNIFICANCE OF SOIL HEALTH AND SOIL QUALITY

To maintain animal and plant productivity, keep water or beautify the air, and ensure human habitation and fitness, soil quality must be maintained (Karlen et al., 1997; Arshad and Martin, 2002). Thanks to the use of soil health crops in recent years, soil disease resistance has been understood for decades (Janvier et al., 2007). Van Bruggen and Semenov defined soil health as the soil's resistance to shocks and stresses (Van Bruggen and Semenov, 2000). Soil quality and soil health sometimes overlap, while soil health discernment tends to focus on biotic soil inputs (Anderson et al., 2003). Soil health determines ecosystem health, which in turn determines animal, human, and plant health (Habberen, 1992; Doran, 2002).

THE SOIL HEALTH FRAMEWORK

The idea of soil quality has developed over time, as has the amount of information available about soils (Karlen and Stott, 1994). While soil quality cannot be directly examined, soil metrics sensitive to management changes can be used as indicators (Andrews and Cambardella, 2004). In addition, explicit targets for preferred final results from the remedies are mentioned. As a result, we can think of soil quality and soil health as a succession of steps.

- Preference of soil health indicators.
- On-farm evaluation and authorization.
- Ascertainment of minimum data set (MDS).
- Improvement of elucidation scheme of indices.

SOIL HEALTH INDICATORS

Soil health indicators are intended to assist smallholder farmers in comprehending the chain of purpose and its impact on everything from decisions to animal and plant health (cite). Soil quality is a different dynamic that might affect land use productivity and sustainability (reward). It disrupts soil conservation and maintenance processes and is controlled by the physical, chemical, and biological components and interconnections of the soil (Papendick and Parr, 1992). However, soil indicators will vary depending on globalisation and the place where quantification is most likely to occur (Riley, 2001).

They are divided into the following categories:

1. **Physical Indicators:** Organic matter additions to soils progress all of the physical qualities of the soil. As a result, a hallmark of soil's physical qualities is its ability to maintain biological activity and plant growth (Structure, tilth, porosity, and water holding capacity). According to Hillel (1982), these are estimates based on porosity, water holding capacity, soil texture, and bulk density (a measure of compaction).

2. **Chemical Indicators:** Chemical soil quality indicators provide information on the soil's ability to distribute minerals and nutrients, based on the pH of the soil. The activity of hydrogen ions in the soil solution is estimated by the pH of the soil. It's also a nutrition indicator for plants. As a result, excessive activity isn't recommended, and soil liming with base cations like Mg or Ca may be

required to bring the solution back to neutral. To achieve high yields, Sanchez and Swaminathan (2005) advised that smallholder farmers give massive amounts of soil nutrients. As a result, adding inorganic fertilizers, using other organic materials such as composts and manures, and including cover crops can all help to diversify the pool of available nutrients (Stocking, 2003).

3. **Biological Indicators:** Soil quality is dynamically driven by micro-biological interceded processes (Doran and Parkin, 1994; Abawi and Widmer, 2000). Biological indicators of soil quality include mineralizable nitrogen, respiration, soil organic matter, and microbial biomass (total bacteria and fungi).

There are various touch-stone to circumspect when choosing soil health and soil quality indicators. Commonly, applicable hands should be: -

- Capable of weighing alteration in soil function both at landscape scales and plot.
- Characteristic of physical, chemical, and biological soil properties.
- Easy to impose.
- It was appraised in time to make management resolutions.
- Delicate to interpretation in the agro-ecological zone.
- Accessible to several farmers.
- Both quantitative and qualitative approaches impose it.

Multiple functions of soils: Soil performs numerous tasks and it was summarized in tables below:

Table 1. A profile of soil functions

Karlen et al. (1997)	Constanza et al. (1992), Bastida et al. (2006)	Harris et al. (1996)	Kelting et al. (1999)	Andrews et al. (2004)
Accommodate Water entry	Physical support, water & Nutrients	Provide plant Nutrients	Store, supply & cycle nutrients	Nutrient cycling
Retain and supply Water to plants	Water flow regulation in the environment	-	Accept, hold and supply water	Water relations
Resist degradation	Environmental buffer or filter	Resist erosion	-	Physical stability and support
Support plant growth	-	Provide a favorable root environment	Promote root growth	Filtering and buffering
			Helps to gas exchange	Resistance and resilience
			Encourage biological activity	Biodiversity and habitat

Table 2. Abridgement of soil health indicators used to appraise soil functions

Indicator	Soil Functions
Soil organic matter (SOM)	Soil structure, stability, and nutrient retention are important (Carter, 2002)
Physical: Stability of soil aggregates, infiltration, and bulk density	Water and nutrient retention; macro- and microfauna habitat (Bengtsson, 1998; Swift et al., 2004)
Chemical: pH, extractable soil nutrients, N-P-K and base cations Ca, Mg & K	Plant-available nutrients, N&P potential, and Ca, Mg, and K loss thresholds (Doran & Jones,1996a; Drink water et al.,1996)

Biological: Microbial biomass C and N content; potentially mineralizable N	Soil productivity and N supply potential; microbial C and N storage capacity (Cadisch and Giller,1997; Doran & Jones, 1996b)

ON-FARM SOIL HEALTH ASSESSMENT

On-farm soil health and quality assessments help farmers analyse the impact of attendance resolutions on soil productivity (Andrews and Carroll, 2001). Similarly, connecting on-farm mythology to soil health gen enhances dialogue among academics, policymakers, and extension personnel (Figure 1). The most daring problem is to design non-theoretical and farmer-friendly soil health and soil quality parameters (Barrios and Trejo, 2003). Simplifying data collection by combining soil health variables with farmer views of soil quality (Barrios et al., 2006; Murage et al., 2000). Using regional data, smallholder farmers can estimate soil quality and yields.

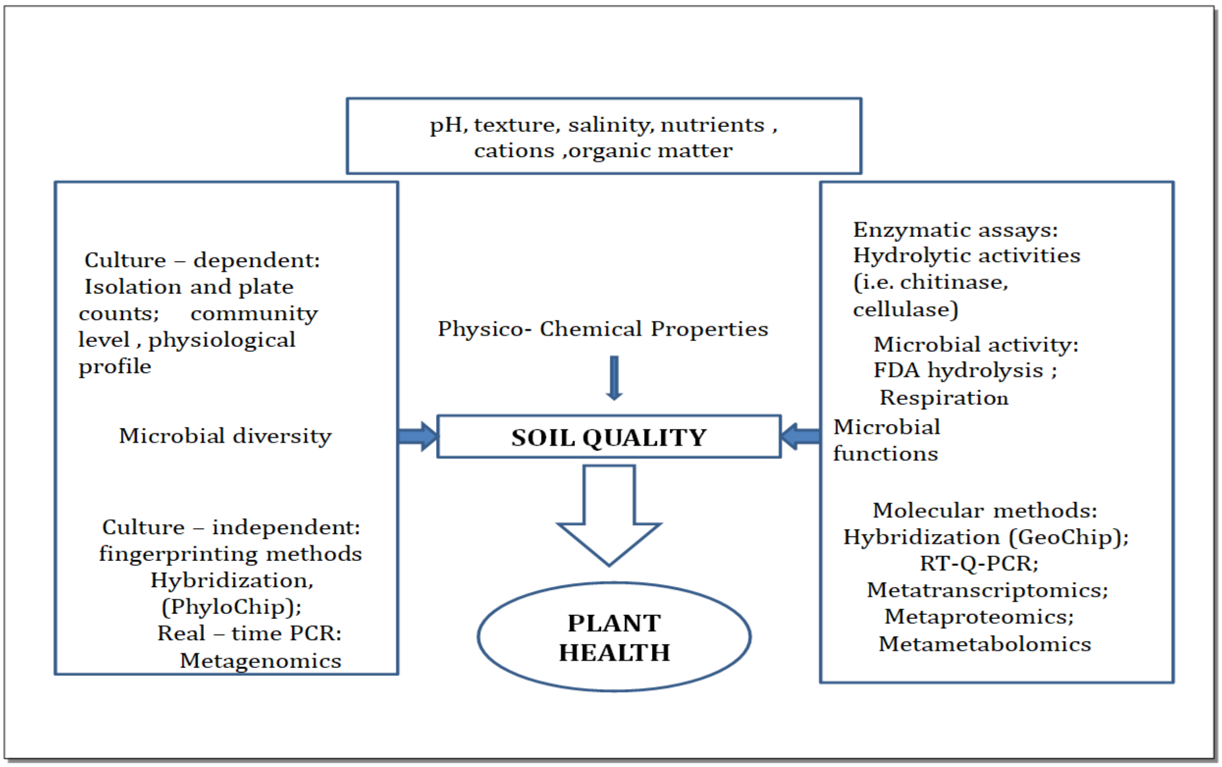

Figure 1. Parameters affect soil quality and some of the methodologies for their assessment. [Source: Antonio de Vicente, Diversity (2012), Institute for Horticultural Mediterranean and Subtropical Horticulture "La Mayora" (UMACSIC), Malaga, Spain].

1. **Soil quality test kits:** Evaluation implements like soil quality test kits (Liebig et al., 1996) concrete on farmers-based assessments and knowledge concerning soil and their management practices of smallholder farmers. Further, the level (aim) to churn out indoctrination implements to raise the awareness to the public of soil quality significance. These kits are capitalistically acquirable, supply for dimensions of water content, soil infiltration, bulk density, respiration, pH, electric conductivity (E.C.), slake test, soil nitrates, numbers of earthworm, aggregate stability (USDA,1999). Unfortunately, the latest corroboration of the kit is handed over by Seybold et al. (2002).
2. **Scorecards:** Scorecards are used for soil quality evaluation on-farm is prioritized where approximate contemplations of soil health are achieved to gain all-embracing soil health and soil quality measurements (Roming et al., 1995). The scorecards described above may evolve to Properties of soil. These soil features are categorized in expressions of illustrative soil indicators, which are elucidated on a scaled

grade. For instance, such contemplations on earthworms can accede to a standard catalog of soil biological activity.

3. **Soil Quality Indices:** For multi-faceted resolution adoption, Soil Quality Indices define implements (Karlen and Stott 1994). In spite of the fact that several fertility indices and soil quality measures have been reported (Stefanic et al. 1984, Beck 1984, Karlen et al. 1998, Trasar-Cepeda et al. 1998, Andrews et al. Adopting Andrews et al. (2002), Bastida et al. (2006) presented micro-biological soil degradation indexes (Figure 2).

SOIL QUALITY INDEX = f (*SP, P, E, H, ER, BD, FQ, MI*)

Here,

SP	Soil Property
P	Potential Productivity
E	Environmental Factor
H	Health of human and animals
ER	Erodibility
BD	Biological Diversity
FQ	Food Quality
MI	Management Inputs

Figure 2. Soil Quality Indices. [Source; Parr et al. (1998)]

COMPETING INTERESTS

The authors declare that they have no competing interests

DATA AVAILABILITY STATEMENT

The raw data used to support the findings of this study are available from the corresponding author upon request.

CONCLUSION

This review concluded that altering soil health situations requires providing a face-lift to the soil biological indicator. Soil health can be improved by accepting the relevant crops and cropping patterns that insulate more carbon. Therefore, the assessment of soil health biological indicators has prime significance. Although several indices and hands of soil health and soil quality have been introduced around the world, they are admissible and relevant specifications, descriptions, and procedures for soil health and soil quality assessment are nevertheless no longer in place. Concomitantly, analysis of soil's physical, chemical, and biological features is indispensable to assess the sustainability or non-sustainability of various controllable practices; maximum research in growing nations has checked out physical and chemical traits only.

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