Enhancing Soil Health Assessment through Soil Health Card

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ABSTRACT

Soil health assessment plays a pivotal role in sustainable agricultural practices, ensuring optimal crop productivity and environmental stewardship. Soil health cards has revolutionized this process by providing farmers with valuable insights into their soil's condition, enabling informed decision-making and targeted interventions. This study presents a comprehensive analysis of the soil health care system, focusing on its key components and impact on agricultural practices. The soil health card incorporates various parameters including physical, chemical, and biological properties, offering a holistic view of soil fertility and quality. Key indicators such as pH, organic carbon content, nutrient levels, and microbial activity are assessed, providing a baseline for soil management strategies. Through the integration of modern technologies such as GIS and remote sensing, spatial variability in soil health parameters is captured, facilitating site-specific recommendations. Furthermore, the implementation of soil health cards has led to enhanced adoption of soil conservation practices and improved resource management. By empowering farmers with personalized recommendations tailored to their specific soil conditions, the efficiency of inputs such as fertilizers and irrigation water is optimized, minimizing environmental impact, and maximizing economic returns. In conclusion, soil health cards serve as invaluable tools in

promoting sustainable agricultural practices and enhancing soil productivity. By facilitating data-driven decision-making and promoting the adoption of best management practices, they contribute to the long-term resilience of agroecosystems. Continued research and innovation in soil health assessment methodologies are essential to further refine the effectiveness of soil health cards and ensure their widespread adoption for improved agricultural sustainability.

INTRODUCTION

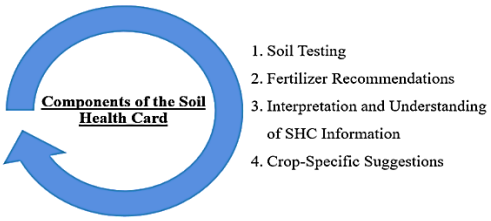
Soil health is the backbone of agricultural productivity and sustainability. The soil's dynamic physical, chemical, and biological properties foster plant growth and the ecosystem's well-being. Plants can grow and yield abundant harvests when their roots have healthy levels of oxygen, water, and nutrients **(FAO, 2015).** India's soil quality has declined as a result of unsustainable farming practices, excessive chemical input use, uneven fertilizer application, and soil erosion **(Ghosh *et al.*, 2018)**. Reduced agricultural output, higher input costs, and detrimental environmental effects, including groundwater pollution and greenhouse gas emissions, have all been brought on by this deterioration in soil health **(Lal, 2015).** The Soil Health Card (SHC) is a comprehensive report card that provides critical information about the soil's health to farmers. The Soil Health Card Scheme is a government initiative launched in India on February 19, 2015, by Narendra Modi in Suratgarh, Rajasthan. 12 key soil testing parameters are included in the SHC, including **physicochemical parameters (**pH, EC, and OC). **Macronutrients:** N, P, K, & S; **Micronutrients:** Zn, Fe, Cu, Mn, and B. Soil health cards are generated by the Ministry of Agriculture and Farmers Welfare, Department of Agriculture and Farmers Welfare, and also have the tagline "**Swasth Dhara Khet Hara**." To assess the current status of the soil's health and to promote the judicious use of fertilizers. This will help farmers to plan their crops and make optimum use of the resources available for them.

Objective of SHC –

- To improve the soil quality and profitability of farmers.
- To Promote sustainable agricultural practices and the judicious use of chemical fertilizers.
- To Enhance crop productivity and farmer income through improved soil health.
- To Reduce environmental degradation caused by excessive and imbalanced fertilizer application.

Benefits of soil health card - The soil health card scheme will properly examine the farmer's soil and accordingly give them a formatted report so that they can decide upon which types of crops to cultivate for more income, reduces input costs, improves soil fertility an also Increases crop productivity and yields. Farmers can access Nutrient presence and deficiencies and Presence of other nutrients. Promotes Sustainable Agriculture practices such as organic farming, crop rotation, and intercropping, which can help to improve soil health (Reddy *et al.*, 2023).

Components of the soil health card –



1. Soil Testing

1.1 Who and Where will the soil sample be tested?

- At the STLs owned by the Department of Agriculture and by their own staff.
- At the STLs owned by the Department of Agriculture but by the staff of the outsourced agency.
- At the STLs owned by the outsourced agency and by their staff.
- At ICAR Institutions including KVKs and SAUs.

At the laboratories of the Science Colleges/Universities by the students under supervision of a Professor/ Scientist.

1.2 Methods of Soil Sampling and Processing –

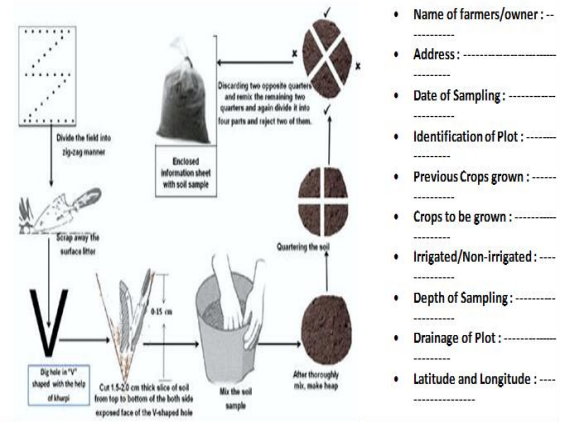


Fig. 1 (Parewa *et al.*, 2016)

i. Soil samples will be drawn in a grid of per ha in irrigated area and 10 ha in rain-fed area with the help of GPS tools and revenue maps.

ii. The State Government will collect samples through the staff of their Department of Agriculture or through the staff of an outsourced agency. The State Government may also involve the students of local Agriculture / Science Colleges.

iii. Soil Samples are taken generally two times in a year, after harvesting of Rabi and Kharif Crop respectively or when there is no standing crop in the field.

iv. Soil samples will be collected by a trained person from a depth of 0–15 cm by cutting the soil in a "V" shape. It will be collected from four corners and the center of the field and mixed thoroughly, and a part of this will be picked up as a sample. Areas with shade will be avoided. The sample chosen will be bagged and coded. It will then be transferred to the soil test laboratory for analysis.

2. Fertilizer Recommendations

Based on the soil testing results, the SHC provides crop-specific fertilizer recommendations that indicate the appropriate type and amount of fertilizer to apply for optimal crop growth and productivity. These recommendations are tailored to the specific nutrient requirements of the crops being grown and the soil's available nutrient levels, enabling farmers to practice balanced fertilizer application and avoid over- or under-fertilization. By following these recommendations, farmers can optimize their fertilizer use, improve crop productivity, reduce input costs, and minimize the negative environmental impacts associated with excessive fertilizer application, such as groundwater pollution and greenhouse gas emissions (Lal, 2015).

2.1 Soil fertility ratings for available nutrients

Nutrients	Fertility rating major nutrients		
	Low	Medium	High
Organic carbon (g kg-1)	<5	5-7.5	>7.5
Macronutrients (kg ha-1)			
Nitrogen (N)	<280	280-560	>560
Phosphorus (P2O5)	<22.5	22.5-55	>55
Potassium (K2O)	<140	140-330	>330
Sulphur (S) (mg kg-1)	<10	10-20	>20
Micronutrients (mg kg-1)	**Deficient**	**Sufficient**	**Excess**
Zinc (Zn)	<0.6	0.6-1.5	>1.5
Iron (Fe)	<2.5	2.5-4.5	>4.5
Copper (Cu)	<0.2	0.2-5.0	>5.0
Manganese (Mn)	<2.0	2-4	>4.0

Source: Soil testing and fertilizer recommendation, By R. B. Basak

3. **Interpretation and Understanding of SHC Information-** This involves presenting the SHC data in a clear and accessible format, using simple language, visual aids, and color-coded indicators to convey the soil's nutrient status and management recommendations **(MoA&FW, 2016)**. It is crucial to strengthen the capacity of agricultural extension officers and other stakeholders to effectively communicate the SHC information to farmers and provide timely and relevant advice on soil health and nutrient management. This may involve training extension officers in soil testing methodologies, interpretation of SHC data, and communication of SHC recommendations to farmers, as well as developing and disseminating educational materials, such as posters, pamphlets, and videos, to raise awareness about the importance of soil health and the benefits of the SHC program.

4. **Crop-Specific Suggestions -** The SHC provides crop-specific suggestions that can help farmers select the suitable crops for their soil conditions and implement appropriate management practices to enhance crop productivity and soil health. These suggestions may include information about suitable crop rotations, intercropping systems, and soil amendments, as well as guidance on irrigation management, pest and disease control, and other aspects of crop production. By taking into account the soil's nutrient status, pH, organic carbon content, and other essential nutrient, these crop-specific suggestions can help farmers make more informed decisions about crop selection and management, ultimately leading to increased agricultural productivity and sustainability **(Gupta *et al.*, 2019).**

4.1 Optimum pH range for different crops –

Crop	Soil pH
Rice, tea	**4.0-6.0**
Wheat, barley, oats, sorghum, maize, sugarcane, berseem, sunflower	**6.0-7.5**
Pearl millet, cotton, groundnut, cowpea	**5.0-6.5**
Chickpea, lentil, pea, soybean, french bean	**5.5-7.0**
Sugarbeat	**6.5-8.0**
Potato	**5.0-5.5**
Tobacco	**5.5-7.5**

Source: Introductory Soil science by D. K. Das

Challenges Faced in Implementation –

- Limited Availability of Soil Testing Facilities.
- Training and Capacity Building of Stakeholders.
- Information Dissemination and Farmer Awareness.
- Lack of knowledge about the importance of soil health.

- Lack of mobile soil testing vans.
- Unavailability of soil testing expert in market.

CONCLUSION

The Soil Health Card (SHC) scheme in India has made significant strides in promoting sustainable agriculture, improving soil health, and enhancing crop productivity and farmer income. Soil testing is necessary to assess soil fertility and nutrient absorption capacity. For implementation to be successful, results must be reported on schedule. Soil Health Cards help reduce the use of chemical fertilizers by promoting proper soil management.

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