Soil Health Card Scheme and Sustainable Soil Management in India: A Review of Farmer Awareness, Utilization and Impact on Agricultural Productivity

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Abstract

Soil health is a fundamental component of sustainable agriculture and plays a crucial role in ensuring long-term agricultural productivity, environmental stability, and food security. In India, rapid agricultural intensification following the Green Revolution significantly increased crop production but also resulted in soil degradation, nutrient imbalance, and declining soil fertility. Excessive use of chemical fertilizers, limited application of organic matter, and continuous monocropping systems have adversely affected soil quality across many agricultural regions. Recognizing these challenges, the Soil Health Card Scheme was launched by the Government of India in 2015 to promote balanced fertilizer use and scientific soil nutrient management. The scheme aims to provide farmers with soil nutrient information and crop-specific fertilizer recommendations through soil testing and advisory services. This review paper examines the concept of soil health, the objectives and implementation of the Soil Health Card Scheme, farmer awareness and utilization patterns, socio-economic determinants influencing adoption, and the role of extension services in promoting sustainable soil management. The paper further highlights the constraints faced by farmers and proposes strategic recommendations for improving the effectiveness of the program. The review concludes that strengthening soil testing infrastructure, enhancing farmer education, and improving extension services are essential for maximizing the benefits of the Soil Health Card Scheme and achieving sustainable agricultural development in India.

1. Introduction

Soil is the most essential natural resource for agricultural production and environmental sustainability. It functions as a living system that supports plant growth, regulates water flow, recycles nutrients, and maintains ecological balance. Healthy soil ensures proper availability of nutrients, improved soil structure, enhanced microbial activity,

and efficient water retention, all of which contribute to higher crop productivity. However, modern agricultural practices have increasingly placed pressure on soil resources. In India, the adoption of intensive farming methods after the Green Revolution led to significant increases in crop yields but also caused widespread soil degradation. Continuous cultivation, excessive use of chemical fertilizers, and insufficient organic matter application have resulted in nutrient imbalance and declining soil fertility in many parts of the country.

The deterioration of soil health has become a major concern for agricultural sustainability. Soil degradation not only reduces crop productivity but also affects environmental quality by contributing to water pollution, greenhouse gas emissions, and biodiversity loss. In order to address these challenges, sustainable soil management practices must be adopted. One of the most significant initiatives taken by the Indian government to improve soil fertility and promote balanced fertilization is the Soil Health Card Scheme. This program provides farmers with detailed information regarding the nutrient status of their soil and offers recommendations for appropriate fertilizer application. By encouraging scientific nutrient management, the scheme aims to improve soil health, reduce input costs, and enhance agricultural productivity.

2. Concept of Soil Health

Soil health refers to the capacity of soil to function as a living ecosystem that sustains plants, animals, and human beings. It involves the interaction of physical, chemical, and biological properties that collectively determine the productivity and sustainability of agricultural systems. Soil with good health maintains proper structure, balanced nutrient levels, sufficient organic matter, and active microbial communities. These characteristics allow soil to support plant growth while simultaneously maintaining environmental quality.

The concept of soil health has gained increasing importance in modern agriculture as farmers and policymakers recognize the long-term consequences of soil degradation. Sustainable soil management practices such as crop rotation, organic manure application, integrated nutrient management, and conservation agriculture are essential for maintaining soil fertility and preventing environmental damage. Healthy soils not only support crop production but also contribute to climate change mitigation by storing carbon and improving ecosystem resilience.

3. Soil Health Problems in Indian Agriculture

Indian agriculture currently faces several soil-related challenges that threaten long-term productivity. One of the most significant issues is nutrient imbalance caused by the disproportionate use of nitrogen fertilizers compared to phosphorus and potassium. Farmers often apply large quantities of nitrogen-based fertilizers because they produce immediate visible effects on crop growth, while the importance of other nutrients is often overlooked. As a result, many agricultural soils suffer from deficiencies of essential nutrients, including micronutrients such as zinc, iron, and boron.

Another major problem is soil degradation resulting from erosion, salinity, and waterlogging. Unsustainable irrigation practices and poor drainage systems contribute to salinity and alkalinity in certain regions, reducing the productivity of agricultural land. Continuous monocropping systems also deplete soil nutrients and reduce organic matter content. Declining soil organic carbon is a widespread problem that affects soil structure, water retention capacity, and microbial activity. In addition, excessive use of pesticides and chemical inputs can contaminate soil and water resources, further compromising environmental health.

4. Soil Health Card Scheme

To address the growing concerns related to soil degradation and nutrient imbalance, the Soil Health Card Scheme was introduced by the Government of India in 2015. The primary objective of the scheme is to provide farmers with accurate information regarding the nutrient status of their soil and to promote balanced fertilizer application based on scientific recommendations. The program involves systematic collection of soil samples from farmers' fields, laboratory analysis of soil properties, and distribution of soil health cards containing detailed information about nutrient levels and recommended fertilizer doses.

The Soil Health Card provides information on key soil parameters including nitrogen, phosphorus, potassium, organic carbon, pH, and micronutrients. Based on these parameters, farmers receive crop-specific fertilizer recommendations designed to improve soil fertility and enhance crop productivity. The scheme is implemented through a network of soil testing laboratories and extension agencies that assist farmers in understanding and utilizing the information provided in the soil health cards.

5. Farmer Awareness and Utilization of Soil Health Cards

Farmer awareness plays a crucial role in determining the effectiveness of the Soil Health Card Scheme. Although millions of soil health cards have been distributed across the country, the extent to which farmers understand and utilize the information varies considerably. Farmers who have access to extension services, agricultural training programs, and demonstration activities are more likely to adopt soil testing recommendations and practice balanced fertilization.

Education level is an important factor influencing farmer awareness. Farmers with higher levels of education generally have better understanding of soil test results and are more willing to adopt scientific nutrient management practices. Exposure to mass media, agricultural extension workers, and farmer training programs also significantly improves awareness levels. However, in many rural areas, farmers still rely heavily on traditional knowledge and may not fully understand the technical information provided in soil health cards.

6. Socio-Economic Factors Affecting Adoption

The adoption of soil health card recommendations is influenced by several socio-economic factors. Age, education, farm size, farming experience, and access to agricultural extension services all play significant roles in shaping farmer behavior. Younger and middle-aged farmers tend to be more open to adopting new agricultural technologies compared to older farmers who often rely on traditional farming practices. Larger farm owners may have greater financial capacity to adopt recommended fertilizer practices, while small and marginal farmers may face resource constraints that limit their ability to follow scientific recommendations.

Family size and availability of labor also influence farm management decisions. Farmers with larger families may have greater labor resources available for implementing improved agricultural practices. In addition, participation in farmer organizations, cooperatives, and self-help groups can enhance knowledge sharing and encourage adoption of soil health management practices.

7. Role of Agricultural Extension Services

Agricultural extension services play a vital role in bridging the gap between scientific research and practical farming. Extension workers help farmers interpret soil test reports, understand fertilizer recommendations, and implement appropriate soil management practices. Training programs, field demonstrations, and farmer meetings are effective methods for increasing awareness about the Soil Health Card Scheme.

Extension agencies also facilitate communication between researchers and farmers, ensuring that scientific innovations are adapted to local farming conditions. Strengthening extension services is therefore essential for improving the utilization of soil health cards and promoting sustainable agricultural practices.

8. Constraints in Implementation

Despite the potential benefits of the Soil Health Card Scheme, several constraints limit its effectiveness. One of the major challenges is the limited availability of soil testing laboratories, which often results in delays in soil sample analysis and distribution of soil health cards. Many farmers also face difficulties in understanding technical soil test recommendations due to lack of training and guidance.

Inadequate extension support and limited awareness campaigns further restrict the adoption of soil health management practices. In some cases, farmers may not trust the recommendations provided in soil health cards because they conflict with traditional farming practices. Addressing these challenges requires strengthening institutional support, improving farmer education, and expanding soil testing infrastructure.

9. Conclusion

The Soil Health Card Scheme represents a significant step toward promoting sustainable soil management and balanced fertilizer use in India. By providing farmers with scientific information about soil nutrient status and fertilizer recommendations, the scheme has the potential to improve soil fertility, increase crop productivity, and reduce environmental pollution. However, the success of the program largely depends on farmer awareness, effective extension services, and timely soil testing.

Improving soil health is essential for ensuring long-term agricultural sustainability and food security.

Strengthening soil testing infrastructure, enhancing farmer training programs, and promoting integrated nutrient management practices will further increase the effectiveness of the Soil Health Card Scheme. A coordinated effort involving policymakers, researchers, extension workers, and farmers is necessary to achieve sustainable soil management and agricultural development in India.

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