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Soil Health Management Practices in Indian Agricultural System: An Analytical Study of Organic Farmers

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Abstract

A large part of India's economy relies on the work of farmers, who are on average the most common residents of this country. Therefore, any research on the key aspects of agriculture is extremely crucial. Any agricultural land will be unproductive without quality soil that is healthy, fertile, and highly fruitful. Organic farming is a sustainably mindful and environmentally friendly way of farming that promotes the use of natural fertilizers and pest control methods, which can help improve soil quality over time. Additionally, organic produce is often in high demand due to its perceived health benefits and lack of harmful chemicals. For this reason, organic farming is gaining popularity among the common man—both the producers and the consumers. For the producers, the advantages include reduced input costs, improved soil quality and market access, and a reduced carbon footprint. For consumers, an enhanced taste and natural safety are always attractive choices. Moreover, the enlightened consumer might want to inculcate more environmentally sustainable and ethical choices in their life. This paper aims to analyse different soil health management practises, such as organic farming, in the Indian agricultural system.

Keywords: Agriculture, Organic Farming, Soil Health Management, Soil Quality

Introduction

Contrary to popular belief, organic farming does not return us to antiquated practises from the 18th century. Farming organically inculcates new and modern innovations like biopesticides and biofertilizers, contemporary machinery, and precision agriculture techniques that optimise yields and minimise waste. The goal of organic farming is to minimise or completely eliminate the use of harmful man-made fertilizers, chemical pesticides, additional non-natural hormones or plant growth regulators, and livestock feed additives (Aulakh & Ravisankar, 2017). Although we may not realise it, the products with which we begin and end our days are produced organically, at least in India. One's morning tea or coffee, the afternoon's wheat, millet, cereals or rice, the evening's mango, banana, pineapple, or sugarcane, and the night's tomato, potato, okra, or bitter gourd are all fruitful products of organic farming. Even the spices

we so adore, without which Indian food is incomplete—turmeric, clove, nutmeg, cinnamon, chilli, cardamom, mustard, parsley, and ginger—are all produced by organic farming (Mitra, & Devi, 2016).

The idea of soil health has been a part of agronomy and related sciences for almost a century, but research and development on soil management and health have mainly taken place in the past three decades. Over time, the idea of soil health has evolved and now encompasses ecosystem services, ecological components, biodiverse nature, and human health. Agricultural research, particularly in soil science, has been established in India for nearly a century and is now on solid ground. Through this century, many popular practices have existed, such the Green Revolution and inorganic farming. The Green Revolution introduced high-yielding cultivar varieties and exponentially increased the use of chemical fertility agents and pesticides. While it resulted in increased food production, it also caused several negative impacts, including soil degradation, water pollution, and health issues for farmers and consumers. Inorganic farming, which relies heavily on chemical inputs, also poses similar problems. The excessive use of synthetic herbicides and pesticides has led to soil erosion and degradation, reduced crop productivity, and health hazards for farmers and consumers (Santhoshkumar, Reddy & Sangwan, 2017). Organic farming can surely act as a viable alternative to overcome these issues.

What is interesting to note is that although a rapidly increasing number of farmers are using organic farming as a tool, a very small part of the land area has been covered, in India. Only 26% of cultivable area is under organic horticulture, while the remaining 74% is under forest cover. This shows that there are significant challenges that must be addressed in order to establish organic farming as a sustainable practice in the food and dairy production industry. One major impediment is the lack of enlightenment and understanding about organic farming practises among farmers and consumers. This can lead to difficulties in marketing organic products due to lack of institutional target groups, which is crucial for organic farming. Additionally, developing countries like India are lacking in infrastructure and support systems, especially from the government. This is also creating an issue in driving up input costs and limiting yields (Wani et. al., 2017).

Literature Review

Soil health can be defined as the ability of the soil to act as a living system that sustains all ita ecosystem components- plants, animals, and humans. It is critical for ensuring healthy crop

productivity, sustainable agriculture and environmental conservation. Physical, chemical, and biological indices help one judge the quality. Rotating crops, cropping them, using cover crops, managing nutrients at the right concentration, reducing tillage and integrating livestock into the farmland are examples of sustainable soil management practises that can help to improve soil health and increase productive yield while minimising negative environmental impacts. Soil organic matter, supplemented by a rich growth of beneficial microbiota, is an important factor in improving soil health (Velmourougane & Blaise, 2017). Therefore, a holistic approach to soil management is needed that results in certain ideal characteristics, such as ones elucidated by Velmourougane & Blaise (2017). These include —high structural stability and biological activity which can be achieved by adding healthy organic matter, high buffering capacity maintained by a balanced nutrient supply, high moisture-holding capacity, and most obviously a low insect, pest and pathogen pollution. Soil health management practices have evolved tremendously in the last 6–7 decades, mainly from 1929 (when the Imperial (now Indian) Council of Agricultural Research was established) to the present (Sharma, Singh & Sharma, 2016). India has transitioned from composting and fertiliser research in the pre-independence era to discovering the need for micronutrients, microorganisms, and organic farming in the post-independence era. However, in the last three decades, the focal point has been conservation agriculture, which emphasises sustainability and environmental preservation. Moreover, technological advancements such as remote sensing, GPS, and GIS for making soil fertility maps, and high-throughput techniques for studying the rhizospheric microflora and microfauna have developed (Yadav et al., 2013).

In the Indo-Gangetic plains, the land of blessed fertility and abundant harvests, agriculture has been the mainstay of the economy for centuries. The region is famous for producing a variety of crops, including but not limited to rice, wheat, sugarcane, and cotton. Another mention of conservation agriculture comes from Nishant et al. (2017). According to them, this method helps to improve soil structure, water infiltration, and soil organic matter content. They have given insights on the varied soil health management practises being used in the Indi-Gangetic plains, ranging from land levelling to balanced fertilization. These include integrated nutrient management, which involves the use of organic and inorganic fertilizers to improve soil fertility and nutrient availability. The nutrient inputs and outputs must be balanced with each other in order to maintain soil health and prevent soil degradation. Intercropping aids in improving soil health and reducing soil erosion. Mention of small sustainable tips used by farmers, such as manual removal of weeds, shifting grazing, choice of local and native crops

over foreign cultivars, maintaining a high crop diversity, and use of natural pest managers such as bats and insects, has been made. These practices help to enhance soil organic matter, and improve soil structure and water holding capacity, eventually leading to the abundant harvests as mentioned before.

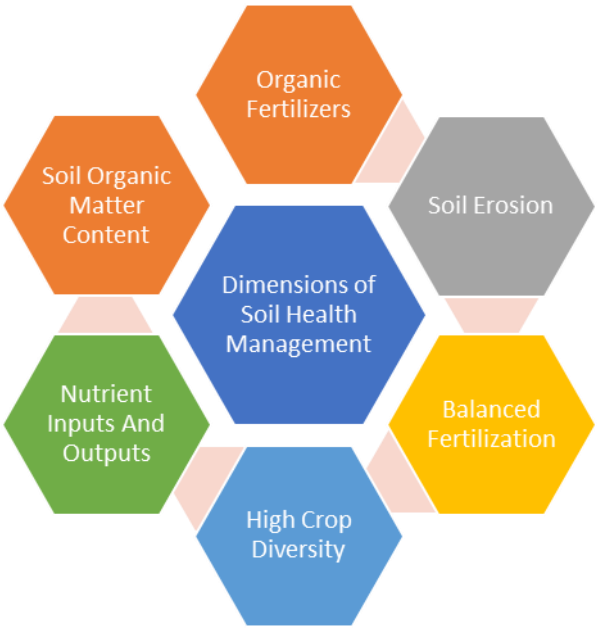

Figure 1 Dimensions of Soil Health Management

A lot of attention is given to efficient soil microorganisms; every day, researchers are busy discovering tiny microbes that can catalyse reactions previously uncatalysed by natural means. Whether it's new organisms that can successfully bring about plastic degradation or the enhancement of an existing microbiome to stimulate them into carrying out bioremediation of polluted soils, these microscopic creatures can truly do it all! Singh, Pandey, & Singh (2011) elucidate many such examples of organism use in agriculture in India— application of plant growth promoting rhizobacteria led to decreased incidence of BBTV (Banana bunchy top virus) in the hill banana variety of Tamil Nadu, under greenhouse and field conditions (Kavino et al., 2007 as cited in Singh, Pandey, & Singh, 2011). The use of *Cyanobacteria* as biofertilisers, especially in the growth of rice, has also been mentioned. The *Cyanobacterium* does not work in isolation; it shows a synergistic mechanism with other soil microorganisms.

Various organic farming techniques used in India are:

i. Pure organic farming involves the complete shunning of inorganic pesticides and fertilizers. In the modern world, this is a little impractical and, as of now, a far-fetched dream.

ii. Integrated organic farming involves a combination of organic farming practices with other complementary methods to optimize the use of available resources while minimizing the negative impact on the environment.

Among the states, certain ones are ahead in the race of organic farming than others- these include Madhya Pradesh, Maharashtra, Kerala, Karnataka, Uttar Pradesh, and Tamil Nadu. North Eastern states like Sikkim, Nagaland and Mizoram are also showing promising growth in this sector. These successes have been achieved because of Governmental supplements like "Paramparagat Krishi Vikas Yojana (PKVY)," "Rashtriya Krishi Vikas Yojana (RKVY)," "Mission Organic Value Chain Development for North Eastern Region (MOVCDNER)," "National Project on Organic Farming (NPOF)," and "Pradhan Mantri Fasal Bima Yojana (PMFBY)" (Yadav, 2017). Support programmes like these provide financial assistance and up to some extent helps in developing stronger infrastructure for organic farming, attracting more and more cultivators to it. Furthermore, these programs also provide training and technical assistance to farmers, which helps them adopt sustainable and organic farming practices, resulting in higher yields and better-quality produce. This not only benefits the farmers but also contributes to the overall growth of the organic agriculture sector in the country.

The ICAR-Indian Institute of Agricultural Research, has developed several key technologies to support organic farming. Most of these were released in 2004 along with the “Network Project on Organic Farming” that covered 13 centres in 12 states. Extensive research on organic farming has proven that the implementation of a scientific set of practices, known as the ‘Package of Practices (PoPs)’, can sustain crop productivity at par with or even higher than conventional chemical farming. It is crucial to adopt these practices in the context of cropping systems to achieve long-term benefits from organic farming. According to ICAR guidelines, to promote organic farming, it is recommended to adopt a phased approach by identifying specific areas and crops that are suitable for organic cultivation. In areas where organic farming is already practiced, such as hill regions and rainfed/dryland areas, a combination of traditional methods, innovative techniques, and scientific organic packages can be used to promote certified organic farming. This will ensure safe food security, climate resilience, and increased income for farming households.

In addition to promoting soil health, organic farming can also help to reduce water pollution and conserve water resources. Because organic landowners rely on natural methods for pest and weed control, they typically use less water than conventional landowners who rely heavily on irrigation. This can help to safeguard water resources in areas of water scarcity and reduce the risk of water pollution from runoff of synthetic fertilizers and pesticides. These pesticides increase the nutrient load of waterbodies and ultimately result in eutrophication. Another essential advantage of organic farming is its potential to improve human health. Organic crops are generally higher in certain nutrients, such as ascorbic acid, iron, and magnesium, compared to conventionally grown crops. Additionally, organic farming practices typically avoid the use of antibiotics and growth hormones in livestock, which can have negative health effects on both animals and humans. By encouraging farmers to use natural methods and avoiding reliance on synthetic inputs, organic farming can help to promote biodiversity and reduce the risk of crop failure due to pests and disease. This can help to create more stable and resilient agricultural systems that can support regional communities and provide food security for future generations (Reddy, 2010).

Elucidating the challenges that haven't been mentioned so far, organic certification requires adherence to strict standards for inputs, production practices, and labelling, which can be complex and costly for farmers to navigate. Additionally, there may be inconsistencies in regulatory standards between countries, which can create challenges for organic farmers who operate in global markets. A key difficulty faced by organic farming is the availability of organic inputs, such as organic fertilizers and pest control products. While the demand for organic products is increasing, there is still a limited supply of organic inputs available, which can make it difficult for organic farmers to obtain the materials they need to maintain soil fertility and control pests. Moreover, a lesser supply also means that the one available comes at a high cost. The careful monitoring required for organic farming also adds to its expense (Jouzi et al., 2017). With a large number of farmers in India already living below the poverty line, organic farming is still a luxury they cannot afford. It is also important to note that the high prices affect the consumers as well. A customer who is unaware of the grave risks of inorganic produce or one who is simply ignorant of them would not go for buying organic crops and would probably call it a 'gimmick.'

Conclusion

Soil health management practices in India are crucial for ensuring sustainable agriculture and environmental conservation. Organic farming, in particular, is a promising practice that can significantly contribute to improving soil health in India. This involves the use of natural inputs such as compost, manure, and bio-fertilizers to improve soil fertility, manage diseases, and enhance soil structure and moisture retention. The hazards of the negative impacts of chemical fertilizers are one too many to elaborate in one paper. This has led to the cumulative government initiatives and programs supporting the growth of organic farming in India. Policies such as the National Programme for Organic Production (NPOP) and the Paramparagat Krishi Vikas Yojana (PKVY) have been key initiatives. These programs provide technical and financial support to farmers to adopt organic farming practices, and also promote organic certification and market linkages for organic produce. Promoting sustainable soil management practices such as organic farming in India can help to improve soil health, multiply agricultural yield, and contribute to environmental conservation. In conclusion, continual support and promotion the such practices can ensure a healthy and productive agricultural system that also thinks ahead of its time.

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