

# Unlocking the Potential of Organic Farming: Balancing Health, Sustainability, and Affordability in India



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## 1 Introduction

Organic farming is gaining global recognition for its focus on sustainability, environmental responsibility, and human well-being. In India, it has emerged as a popular alternative to conventional agriculture, addressing the challenges posed by traditional farming methods. Understanding the health implications, sustainability aspects, economic viability, and policy frameworks associated with organic farming in India is crucial. This review aims to contribute to evidence-based decision-making, policy formulation, and the further advancement of organic farming practices within the country.

Organic farming is characterized by the use of natural inputs and techniques, avoiding synthetic pesticides and fertilizers (Fess et al. 2018). In India, where agriculture plays a vital role in the economy and the livelihoods of many, exploring the potential of organic farming is particularly significant. It emphasizes strategies like crop rotation, companion sowing, and the utilization of organic-based fertilizers, ensuring the avoidance of synthetic or chemical products in agriculture. The origins of organic farming can be traced back to the early twentieth century as a response to evolving farming methods (Šrútek et al. 2008).

Certified organic agriculture covers over half of the world's 70 million hectares, with Australia having a significant share. The promotion of organic farming continues to be widespread, focusing on mixed cropping, insect predator development, and biological pest management. Organic standards aim to limit or regulate the use of synthetic compounds while promoting the use of naturally occurring

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substances. For example, synthetic fertilizers and pesticides are generally prohibited, while naturally occurring alternatives like pyrethrin and rotenone are allowed (Organic farming. 2017). Some synthetic compounds, such as ivermectin, copper sulphate, and elemental sulphur, are permitted. However, certain practices and substances, including nanotechnology, human sludge, plant development regulators, pheromones, and the use of antibiotics in cattle husbandry, are prohibited. Organic farming reflects advantages such as sustainability, openness, individuality, wellness, food security, and food safety.

The debate around the risks of intensive agricultural production, the industrialization of food, and food-related concerns has reignited interest in organic farming. This chapter aims to achieve the following objectives:

- Assess the current status of organic farming in India, including adoption rates, key crops, and the scope of operations.
- Examine the health benefits of organic farming, including the absence of pesticide residues, a comparison of nutritional value between organic and conventional crops, and the potential health advantages associated with consuming organic products.
- Evaluate the ecological impacts of organic farming practices, focusing on soil protection, water management, biodiversity preservation, and carbon sequestration.
- Analyse the affordability of organic food for various demographic groups, considering manufacturing costs, retail prices, and accessibility. Explore strategies to enhance affordability and availability.

This chapter intends to provide a comprehensive review of organic agriculture in India, highlighting its potential benefits and the challenges that need to be addressed. The outcomes can inform the development of data-driven policies and promote sustainable agricultural practices in India, striking a balance between affordability, sustainability, and health.

The subsequent sections will delve into the current context of organic farming in India, discuss initiatives and policies promoting it, identify challenges faced by organic farmers, and explore ways to integrate organic farming practices into Indian agriculture more effectively. This research holds immense significance for stakeholders such as policymakers, farmers, consumers, and the general public. It can lead to informed decision-making, contribute to food safety enhancements, create market opportunities for farmers, promote healthier food choices, encourage sustainable farming methods, support environmental conservation, and improve public health outcomes. Overall, by unlocking the potential of organic farming in India and finding the right equilibrium between health, sustainability, and affordability, this research can have a transformative impact on agriculture, public health, and the environment.

## 2 Overview of Organic Farming in India

In recent years, the organic food market in India has experienced significant growth. This can be attributed to various factors, including the rise in health consciousness among consumers. Many are now paying closer attention to the food they consume and feed their families. The concern for nutrition and quality of food is high, particularly in urban areas where healthier options are available. Economic growth and increased income levels have led to a rise in spending on health and wellness products. The Indian government's investment in organic farming has driven demand for certified organic products. Programs like the National Food Security Mission and National Mission for Sustainable Agriculture provide support to farmers adopting organic farming practices.

### 2.1 Evolution and Growth of Organic Farming in India

The organic farming industry in India has witnessed substantial growth due to traditional agricultural practices prioritizing sustainability. The development of organic farming in India has roots in cultural heritage and ancient techniques like Vrikshayurveda, emphasizing crop rotation and natural pest control (Singh et al. 2018).

Key figures such as Vinoba Bhave and religious groups contributed to the organic agriculture movement, promoting ecological farming practices (Nellyyat et al. 2007). The Indian government recognized the value of organic farming and implemented programs like the National Project on Organic Farming (NPOF) to provide financial aid and technical assistance to farmers transitioning to organic methods (Ministry of Agriculture and Farmers' Welfare n.d.) (Fig. 1).

Establishing organic certification standards was crucial for ensuring credibility and consumer confidence. The National Programme for Organic Production (NPOP) was established in 2001 by the Agricultural and Processed Food Products Export Development Authority (APEDA) to regulate organic farming and facilitate export opportunities (APEDA n.d., Table 1).

India's organic farming industry has experienced remarkable growth, with an increase in the number of organic farmers and certified land. This growth has

Fig. 1 Logo of NPOP India

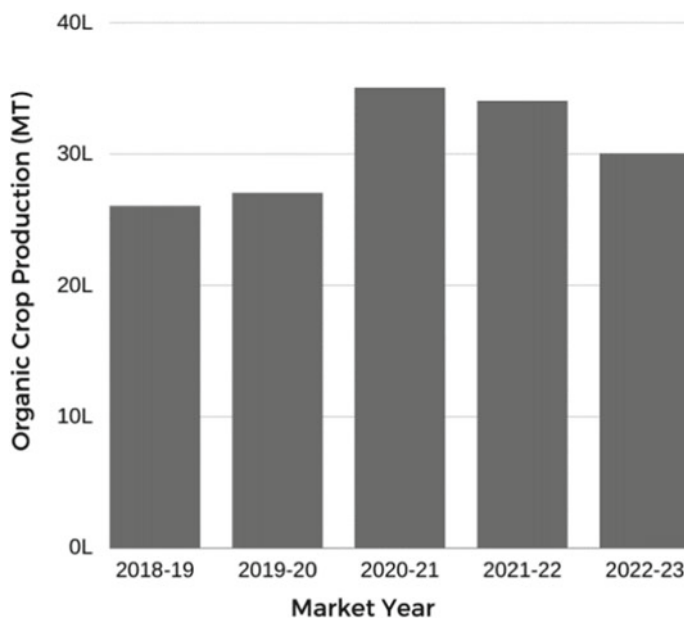


**Table 1** List of Macronutrients important for the growth of plant (Source Wander et al. 2009)

Element	Cationic	Anionic	Other
Nitrogen	NH <sub>4</sub> <sup>+</sup> (ammonium ions)	NO <sub>2</sub> <sup>-</sup> , NO <sub>3</sub> <sup>-</sup>	Organic
Phosphorus	–	HPO <sub>4</sub> <sup>-2</sup> , H <sub>2</sub> PO <sub>3</sub> <sup>-</sup> , polyphosphates	Organic
Potassium	K <sup>+</sup>	–	–
Calcium	Ca <sup>+2</sup>	–	–
Magnesium	Mg <sup>+2</sup>	–	–
Sulphur	–	SO <sub>4</sub> <sup>-2</sup> , S <sub>2</sub> <sup>-2</sup>	Organic

been driven by rising national and international demand for organic products and supportive government initiatives. In summary, organic farming in India has gained momentum due to traditional practices, influential figures, government programs like the NPOF, and the establishment of certification standards through the NPOP. The industry has witnessed significant growth in recent years, driven by increased consumer demand and government support.

Figure 2, based on data from APEDA, highlights the trends in organic crop production in India from 2018–19 to 2022–23 (APEDA n.d.). The analysis reveals moderate initial growth, a significant boost in 2020–21, and a slight decrease thereafter. Factors influencing these trends include market demand, government support, weather conditions, and farming practices.

**Fig. 2** Organic Crop Production (MT) from the Market Year 2018–2023; Source APEDA

India ranks fifth globally and first in Asia in terms of organic farming, with 23 lakh hectares of land dedicated to organic cultivation (FiBL 2021). The country has experienced a strong drive towards organic farming, adding approximately 3.6 lakh hectares of organic farming land. Increasing health consciousness has led to significant growth in the organic food industry, reaching a value of \$849.5 million in 2020, up from \$200 million in 2018 (IFOAM 2017). North India dominates the organic food market, and it is expected to grow at a compound annual growth rate (CAGR) of around 25% from 2022 to 2027.

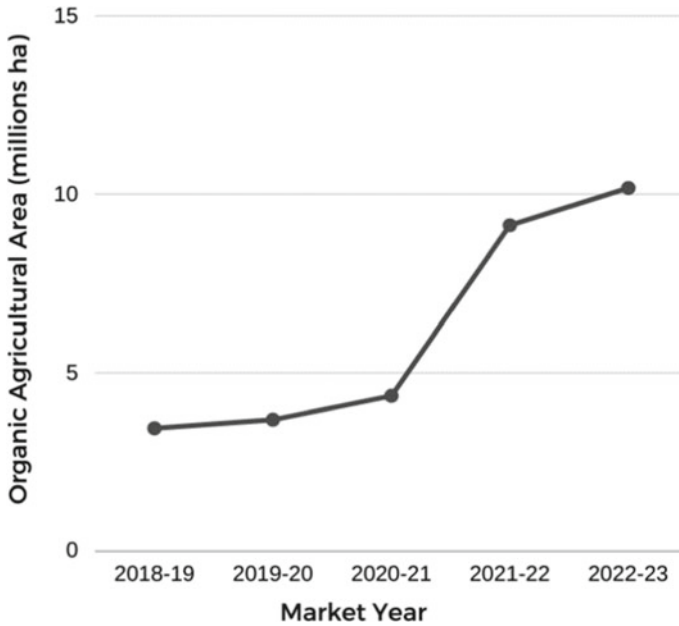
## ***2.2 Current State of Organic Farming Practices***

Organic farming uses cultural practices and preventative measures to minimize external inputs. It involves techniques like crop rotation, soil management, pest and disease control, integrated weed management, and pasture-based livestock management. Soil health is improved through organic matter incorporation, composting, and cover crops, while pest control relies on integrated pest management and natural barriers. Weed suppression is achieved through mechanical cultivation, mulching, and hand weeding, reducing the need for synthetic herbicides. Crop rotation regulates nutrients, disrupts pest cycles, and improves soil health. Livestock management adheres to organic standards, limiting antibiotics and hormones. Overall, organic farming prioritizes sustainability, biodiversity, and reduces reliance on synthetic inputs.

## **3 Trends and Patterns in Organic Farming Adoption**

India has seen significant growth in organic farming, with over 15 million hectares of agricultural land dedicated to organic production, making it the country with the highest percentage of organic farmers worldwide (Abdelgawwad et al. 2013). The adoption of organic farming has increased across different regions and crops, with states like Uttarakhand, Sikkim, Kerala, and Himachal Pradesh leading in organic farming practices (Roychowdhury et al. 2013). Organic cultivation extends to various crops such as rice, wheat, oilseeds, pulses, fruits, vegetables, and livestock. In recent years, India's embrace of organic agricultural methods has revealed some interesting trends (Fig. 3).

The implementation of organic farming in India is driven by several factors. Market demand, both domestically and globally, has encouraged farmers to embrace organic practices due to increased consumer awareness of the benefits, such as lower pesticide residues and higher nutritional value. Environmental concerns, including soil erosion, water pollution, and biodiversity loss associated with conventional



**Fig. 3** Organic agricultural area (millions Ha) from the market year 2018 to 2023 (Source APEDA)

farming, have motivated farmers to adopt organic methods, aligning with their preference for sustainable practices and biodiversity preservation. Furthermore, government support through programs like the Rashtriya Krishi Vikas Yojana (RKVY), National Programme for Organic Production (NPOP), and state-level initiatives has played a crucial role in promoting organic farming among farmers (Ministry of Agriculture and Farmers’ Welfare [n.d.](#)).

In summary, India has experienced significant growth in organic farming, with widespread adoption across regions and crops. Factors such as market demand, environmental concerns, and government support have contributed to the expansion of organic farming practices in the country.

#### **4 Health Implications of Organic Farming**

Organic farming is proven to be healthier for humans and the planet, offering nutrient-dense food without harmful residues (Beyond Pesticides [n.d.](#)). Pesticide use is regulated in organic farming, reducing human exposure to residues found in conventional food. Some pesticides in conventional farming have been linked to negative effects on children’s cognitive growth. Creating sustainable food systems is a priority for intergovernmental groups, considering the long-term viability of agriculture. Various

agricultural practices can impact human health, animal welfare, food security, and environmental sustainability.

## 5 Reduction of Pesticide Exposure and Health Benefits

Excessive use of pesticides and fertilizers in agriculture can lead to biodiversity degradation and pose risks to food safety (Dahiri et al. 2021). Fresh produce, such as fruits and vegetables, are particularly susceptible to pesticide residues, which are regulated by governments to protect consumer health. Pesticide residue testing plays a crucial role in assuring the safety of food items, as prolonged exposure to pesticide residues can be harmful to human health, potentially causing cancer and impacting various bodily systems (Indian Institute of Horticulture Research n.d.).

In contrast, organic farming relies on biological preventative measures and plant protection methods, such as crop rotation, intercropping, resistant varieties, and biological management, reducing the need for synthetic pesticides. While some pesticides are authorized for use in organic farming after thorough assessment, they generally pose minimal risks to consumers, either due to their low toxicity or limited potential for entering the food chain (Beck et al. 2014).

The terms “toxicity” and “risk” have distinct meanings when discussing pesticide safety (Fig. 4). Toxicity refers to a substance’s intrinsic capacity for poison, assessed through laboratory tests, while risk is determined by the interaction between exposure and toxicity (Frank et al. 2011). The potential danger from a pesticide depends on its toxicological properties, volume of exposure, and mode of application (Damalas et al. 2016).

Consumer studies show that the desire to limit pesticide exposure is a significant motivation for people choosing organic foods (Raab et al. 2005). To minimize pesticide exposure, it is essential to transition towards agricultural systems that rely less on pesticides. This can be achieved by adopting ecological crop protection strategies based on current ecological knowledge. Sustainable pest, disease, and weed management systems should focus on prevention, decision-making, and control. Prevention

**Fig. 4** Toxicity and exposure determines risk, *Source* Adapted from Damalas et al. (2016)



involves maximizing the use of biological processes, inhibiting harmful species, optimizing system diversity, and promoting the reuse of internal resources (Ratnadass et al. 2012).

## 6 Nutritional Value of Organic Produce

Organic food is widely perceived as a healthier option, offering higher nutritional value and reduced exposure to harmful chemicals compared to conventionally grown produce. Numerous studies have explored the nutritional composition of organic foods and have yielded varying results, highlighting the complexity of this subject.

When comparing organic and conventional crops, some studies suggest that organic produce may contain higher levels of certain vitamins and minerals. For instance, research has shown that organic fruits and vegetables can have greater concentrations of vitamin C, magnesium, iron, and antioxidants (Barański et al. 2014). These nutrients play crucial roles in supporting overall health and well-being.

Antioxidants, found abundantly in fruits and vegetables, help protect the body against oxidative stress and cellular damage. Some studies indicate that organic crops may exhibit higher antioxidant activity compared to conventionally grown counterparts. The presence of elevated levels of antioxidants, such as flavonoids and phenolic compounds, in organic produce could potentially contribute to a reduced risk of chronic diseases like cardiovascular ailments and certain cancers. Additionally, organic agricultural practices may influence the levels of secondary metabolites in crops. These compounds are responsible for the distinctive flavours, scents, and potential health benefits of plants. Organic farming methods, which avoid synthetic fertilizers and pesticides, have been associated with higher concentrations of certain secondary metabolites like phytochemicals and polyphenols. While further research is needed to fully understand the implications of these compounds on human health, they are believed to offer potential health advantages.

Furthermore, organic produce tends to have lower nitrate levels compared to conventionally grown crops. Nitrate, a naturally occurring compound, can be converted to harmful nitrites and nitrosamines, which have been linked to certain cancers. By choosing organic options, consumers may reduce their exposure to these potentially harmful substances.

It is important to note that the nutritional composition of organic foods can be influenced by various factors, including crop type, soil quality, and environmental conditions. Therefore, focusing on a diverse and balanced diet that includes a variety of fruits, vegetables, and whole foods, regardless of whether they are organic or conventionally grown, is key to optimal nutrition and overall health.



## 7 Impact on Consumer Health and Well-Being

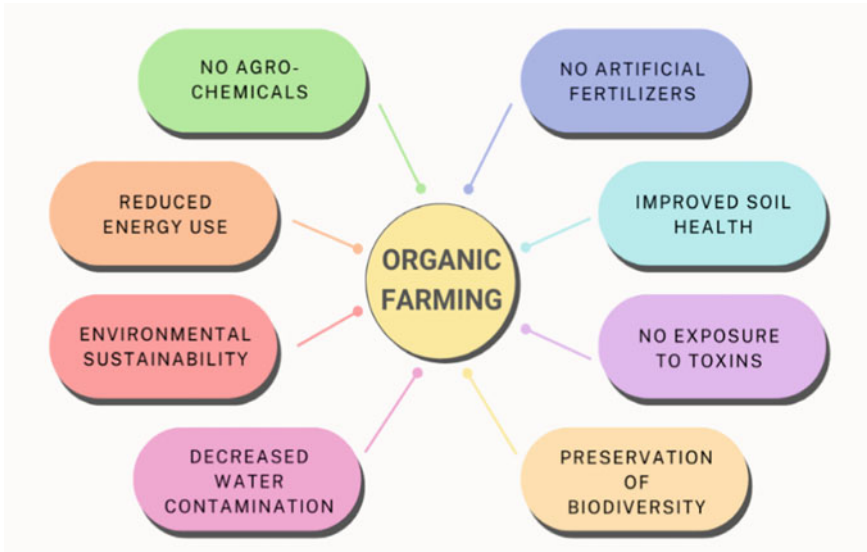
Choosing organic vegetables reduces exposure to synthetic pesticides used in conventional farming. Research shows organic produce has lower pesticide residue levels. While organic farming doesn't eliminate all pesticides, it can help minimize potential health risks. Organic vegetables may contain higher nutrient concentrations, such as vitamin C and antioxidants (Barański et al. 2014). However, nutrient content can vary based on crop variety and farming methods. Organic farming may also reduce allergenic substances in food (Bourn et al. 2002). Consumers associate organic food with improved well-being and sustainability. It's important to consider overall dietary patterns for optimal health, incorporating a variety of foods and safe handling practices.

## 8 Sustainability in Organic Farming

The institutions responsible for establishing rules and policies for agriculture need to be improved. Sustainable agriculture is crucial for preserving ecosystems, ensuring the responsible use of resources, and achieving global food security. It should prioritize profitability, environmental health, social development, and economic progress. To transition to sustainable agriculture, significant progress is required in resource efficiency, environmental protection, and system resilience.

### 8.1 *Environmental Benefits of Organic Farming*

Organic farming promotes sustainability through ecological balance, resource conservation, and long-term profitability. It avoids synthetic chemicals and instead relies on biological processes to maintain soil fertility and crop health. Soil management in organic farming focuses on enhancing fertility through compost and organic matter, supporting soil organisms and nutrient cycling (Fig. 5). Preservation of biodiversity is prioritized through habitat conservation and crop rotations, benefiting natural pest control and ecological balance. Water conservation is achieved through reduced use of synthetic pesticides and fertilizers, along with practices like crop rotation and efficient irrigation. Organic farming also contributes to climate resilience by improving soil health, water management, and reducing greenhouse gas emissions associated with chemical inputs.



**Fig. 5** Environmental benefits of organic farming

## 9 Conservation of Biodiversity and Ecosystem Services

Promoting biodiversity in agricultural systems is crucial for reducing biodiversity loss and maintaining ecosystem services. Agroecological management aims to balance biodiversity conservation and agricultural production, utilizing ecological processes to enhance ecosystem services. However, trade-offs between productivity and biodiversity conservation can hinder the widespread adoption of agroecological practices. Understanding factors that promote synergies and reduce trade-offs is essential for agricultural reform and biodiversity conservation.

Organic farming plays a significant role in biodiversity preservation by creating favourable habitats for a variety of organisms. It supports the preservation of beneficial insects, fauna, and wildlife through practices like crop rotation, intercropping, and habitat preservation. Organic farms have been found to have higher biodiversity compared to conventional farms. Organic farming also sustains and promotes pollinator populations by providing flowering vegetation, minimizing pesticide use, and reducing habitat loss. Organic farming facilitates natural pest management by preserving beneficial insects, birds, and other species that feed on crop pests. This reduces the need for chemical pesticides and contributes to a more stable and resilient ecosystem. Soil microbial populations are also prioritized in organic agriculture, as they play a vital role in nutrient cycling and disease control. Organic practices support diverse soil microbial communities, enhancing soil fertility and ecosystem function.

The preservation of biodiversity in organic farming leads to various ecosystem services such as soil fertility, water purification, pest management, and climate regulation. These services contribute to resilient ecosystems, sustainable agriculture, and human well-being. Organic farming exemplifies the potential of agricultural systems to promote biodiversity conservation and the provision of ecosystem services.

## 10 Soil Health and Organic Farming Practices

Organic farming focuses on promoting healthy soil through practices that enhance soil fertility and biological activity. Organic farmers prioritize the use of compost, cover crops, and crop residues to improve soil organic content, microbial activity, and nutrient retention. This results in higher levels of soil organic matter compared to conventional farming systems. Soil organic matter improves soil structure, nutrient availability, water-holding capacity, and overall soil health (Stockdale et al. 2001). Organic farming also relies on cover crops, mulching, and reduced tillage to maintain soil health and prevent erosion.

The soil biological community, which includes organisms like bacteria, fungi, earthworms, and insects, plays a crucial role in organic farming. Soil microorganisms contribute to nutrient cycling, organic matter decomposition, and plant growth promotion (Stockdale et al. 2001). Beneficial microorganisms help release nutrients for plants, while pathogenic microorganisms can harm crop health and yield. Organic farming practices support a diverse and balanced soil microbial community, contributing to soil fertility and ecosystem functioning. It also has positive environmental impacts. It contributes to greenhouse gas reduction by storing carbon in the soil. They minimize nitrogen losses, resulting in lower emissions of nitrous oxide, a potent greenhouse gas. Organic farmers prioritize nutrient management to ensure optimum plant nutrition, utilizing natural resources and nutrient-recycling techniques (Wander et al. 2009). Crop rotation is a key practice in organic farming, breaking disease and pest cycles, reducing weed growth, and improving soil health. By rotating crops, organic farmers enhance soil biodiversity, nutrient cycling, and pest management (Tables 1, 2 and 3).

To minimize soil disturbance, organic farmers adopt reduced tillage or conservation tillage practices. These practices promote soil structure preservation, organic matter decomposition, moisture retention, erosion control, and overall soil health. Reduced tillage in organic systems improves carbon sequestration and enhances soil physical qualities. Organic farming's focus on soil health and sustainable practices contributes to long-term productivity, environmental preservation, and the overall viability of agriculture.

**Table 2** List of Micronutrients important for the growth of plant (*Source* Wander et al. 2009)

Element	Cationic	Anionic	Other
Iron	Fe, Fe <sup>+2</sup> , Fe <sup>+2</sup>	–	Organic-chelated
Manganese	Mn, Mn <sup>+2</sup>	–	Organic-chelated
Copper	Cu, Cu <sup>+2</sup>	–	Organic-chelated
Zinc	Zn, Zn <sup>+2</sup>	–	Organic-chelated
Molybdenum	–	Mo, MoO <sub>4</sub> <sup>–</sup>	–
Boron	–	Bo, B(OH) <sub>4</sub> <sup>–</sup> , H <sub>3</sub> BO <sub>3</sub>	H <sub>3</sub> BO <sub>3</sub>
Chlorine	–	Cl <sup>–</sup>	–
Nickel	Ni, Ni <sup>+</sup>	–	–

**Table 3** List of Micronutrients important for the growth of animal depending on vegetation, *Source* Adapted from (Wander et al. 2009)

Element	Cationic	Anionic	Other
Cobalt	Co+2	–	–
Selenium	–	SeO <sub>4</sub> <sup>–2</sup> , SeO <sub>3</sub> <sup>–2</sup> , Se <sup>–2</sup>	Organic
Sodium	Na+	–	–
Silicon	–	SiO <sub>2</sub>	–

## 11 Water Conservation and Organic Agriculture

Water resources and clean water security are crucial for global development. Organic farming practices contribute to water conservation and quality preservation. Organic farmers prioritize soil health, which directly affects water retention in agricultural soils. By maintaining organic matter levels, promoting soil aggregation, and minimizing soil compaction through reduced tillage, organic farming enhances soil water-holding capacity and reduces runoff. Organic farmers also select crop varieties that are drought-resistant and adapted to local climate conditions, improving water use efficiency and crop resilience. Water-saving techniques such as drip irrigation, mulching, and accurate watering are commonly employed in organic farming, further reducing water requirements and improving irrigation efficiency (Mäder et al. 2002). Additionally, organic farming reduces water pollution by minimizing the use of synthetic pesticides and chemical fertilizers, thereby protecting water quality and promoting the health of aquatic ecosystems.

## **12 Economic Viability and Affordability of Organic Farming**

The rising demand for organic products has led to higher prices for organic vegetables. Organic farms face additional production costs, such as increased labour inputs and certification expenses, which are reflected in the price premiums. Despite the higher prices, consumers who value health, environmental sustainability, and quality are willing to pay for organic produce. These price premiums provide economic opportunities for organic farmers and help offset the higher production expenses associated with organic farming practices.

## **13 Cost Analysis of Organic Farming Methods**

Analysing the economic feasibility of organic farming requires understanding the costs associated with organic practices. Organic inputs like fertilizers, pest control methods, and seeds may be more expensive than conventional alternatives. However, studies show that long-term savings on synthetic inputs can outweigh the initial expenses of organic farming (Röös et al. 2018).

Labor inputs are also higher in organic farming due to manual weeding and crop rotations, but efficient farm planning and labour-sharing arrangements can help minimize costs. Organic certification comes with fees, but it offers market access, pricing premiums, and consumer trust. Financial sustainability depends on market demand, prices, production costs, yields, and management effectiveness. Organic farms can be as profitable as, or even more profitable than, conventional farms in the long run. Cost-saving strategies include efficient resource use, proper crop planning, pest and disease control, and cooperative marketing. Investing in on-farm facilities can improve operational efficiency and reduce input costs.

## **14 Market Demand and Price Premiums**

The demand for organic products is influenced by customer preferences for nutritious and sustainable options, concerns about environmental impact, and increasing awareness of food safety issues. Organic farming practices align with these ideals, leading to a rising demand for organic produce. Customers are willing to pay higher prices for organic products due to their perceived benefits and the premium placed on organic farming practices. Understanding market dynamics, such as supply and demand patterns, competition, and consumer preferences, is crucial for organic farmers to succeed. Building relationships with merchants, participating in farmers' markets, and engaging in consumer education campaigns can help organic farmer's access target customers and benefit from price premiums.

The distribution chain for organic products includes various levels, from government support and certification to production, packaging, and market representation. Market access is essential for organic producers, and working with organic farmer organizations, direct marketing campaigns, and joining community-supported agriculture (CSA) models can enhance market access and reduce marketing expenses.

## **15 Income Generation and Poverty Alleviation**

Organic farming offers potential revenue generation opportunities for small-scale farmers and rural populations. By demanding price premiums for their products, organic farmers can increase their profits. Additionally, organic farming practices, such as diverse cropping systems and direct marketing avenues like farmer's markets and community-supported agriculture (CSA) models, can create additional income streams and enhance financial security for small-scale farmers. Organic farming's labour-intensive nature also generates job opportunities in rural areas, particularly in regions heavily reliant on agribusiness. Moreover, organic agriculture can strengthen the economic resilience of smallholder farmers by reducing production costs through a decreased reliance on expensive external inputs like chemical pesticides and fertilizers. By empowering small-scale farmers through training programs, technical assistance, and market access, organic farming can enhance the efficiency and sustainability of small-scale agriculture. This, in turn, contributes to poverty reduction by generating income, employment, and empowering marginalized groups, such as women, indigenous peoples, and smallholder farmers. The principles of organic farming, including environmental sustainability, biodiversity preservation, and social responsibility, align with the goals of equitable and inclusive development, supporting broader efforts to reduce poverty.

## **16 Access to Credit and Financial Support**

Access to financial resources is crucial for organic farming as it enables farmers to cover initial investment costs, ongoing expenses, infrastructure development, and marketing efforts. However, organic farmers may face challenges in obtaining loans from traditional financial institutions due to a lack of understanding of organic farming's specific needs and associated risks. Additionally, smaller farmers and those in remote areas may have limited access to financial services. To address these issues, specialized financing programs for organic agriculture have been established, providing tailored credit packages, flexible repayment terms, and technical support. Cooperatives of organic farmers also facilitate resource sharing and collective bargaining, improving access to financing and financial services. Governments may offer grants and subsidies specifically targeted at organic farming, helping farmers with marketing strategies, organic practices, and certification fees. Socially

responsible investors and impact investment funds are also recognizing the potential of organic farming to contribute to environmental and social goals and provide financial support accordingly. Enhancing financial literacy and providing training on managing the business aspects of organic farming are essential for organic producers to make informed financial decisions. Capacity-building programs that include financial strategy, cash flow management, and credit access training can equip organic farmers with the necessary skills to navigate the financial landscape successfully.

## **17 Policy Framework and Government Initiatives**

Governments throughout the world, including India, have adopted extensive laws and programmes that encourage and promote organic agricultural practises in light of the importance of sustainable farming and the rising demand for organic products. In this part, we examine the Indian government's policies and programmes that have helped to promote the development of organic agriculture.

### ***17.1 National and State-Level Policies Supporting Organic Farming***

India has implemented regulations at the national and state levels to support and promote organic farming. The National Programme for Organic Production (NPOP) is a comprehensive regulatory framework that establishes standards for organic certification and labelling (Ministry of Agriculture and Farmers' Welfare [n.d.](#)). It accredits certifying agencies and facilitates the growth of organic agriculture. India also has a dedicated Organic Farming Policy that focuses on sustainable practices, organic inputs, and farmer engagement (MoAFW [2020](#)). Additionally, various states like Sikkim, Himachal Pradesh, Madhya Pradesh, Kerala, and Karnataka have their own organic farming policies and programs in place to encourage organic farming (MoAFW [2020](#)). These initiatives aim to create a systematic and disciplined environment for the organic food industry.

### ***17.2 Government Schemes and Subsidies***

The government of India has implemented several programs and incentives to promote organic farming and support farmers in this sector. The Paramparagat Krishi Vikas Yojana (PKVY) encourages small and marginal farmers to adopt organic farming practices through financial support, training, and accreditation (MoAFW [2020](#)). The Rashtriya Krishi Vikas Yojana (RKVY) provides financial assistance to

state governments to implement state-specific projects for promoting organic farming (MoAFW 2020). The National Horticulture Mission (NHM) supports horticultural development using organic farming methods through funding for inputs, training, and market linkages (MoAFW 2020). The National Bank for Agriculture and Rural Development (NABARD) offers subsidized loans and credit support for farmers practicing organic farming (NABARD Schemes n.d.).

Additionally, the government provides incentives such as assistance in setting up organic production and distribution facilities, crop insurance programs, discounted organic certification, and subsidies for organic inputs. The focus on research and development is evident through the establishment of organic farming research facilities and funding for cooperative projects. These initiatives aim to enhance capacity, improve infrastructure, and facilitate market access for organic farmers in India.

### ***17.3 Regulatory Framework for Organic Certification***

India has established a robust administrative framework for organic certification to ensure the credibility and integrity of organic farming practices. The National Programme for Organic Production (NPOP) has established organic standards to bring consistency and clarity to organic certification across the country (MoAFW n.d.). Accreditation organizations are responsible for accrediting certifying bodies, conducting inspections, and awarding organic certifications to producers and farmers (NABCB Organic Certification n.d.). The certification process involves multiple steps, including documentation review, site visits, sample collection and analysis, and verification of compliance with organic standards. Certification organizations assess farmers' adherence to organic practices such as the use of certified inputs, crop rotation, pest control, and record-keeping. Once certified, farmers and producers are authorized to use the organic mark on their products as proof of compliance (NCOF Organic Certification Process n.d.).

In India, various organizations and institutions are involved in the implementation and supervision of organic certification. The Agricultural and Processed Food Products Export Development Authority (APEDA) plays a key role in promoting organic agriculture and managing the national database of certified organic products (APEDA n.d.). The National Centre of Organic Farming (NCOF) and the National Accreditation Body for Certification Bodies (NABCB) provide accreditation, technical assistance, and training for organic certification. India's organic certification process is recognized by several foreign trade partners, including the US, Canada, EU, and Switzerland, through mutual recognition agreements on organic equivalence (Ministry of Commerce and Industry 2020). These agreements facilitate the export of Indian organic products to international markets by eliminating the need for additional certificates or inspections, as the organic standards and certification processes are considered comparable.



## 18 Challenges and Opportunities in Policy Implementation

In India, the penetration of organic products in the market has been slow, despite having the largest organic acreage. Several factors contribute to this:

- **Partial consumer awareness:** Organic food is often associated with luxury and prestige rather than being seen as a standard choice. Limited knowledge about organic farming leads to consumers viewing it as a posh option, hindering sustainable market growth.
- **Farmer education and support:** Many farmers hesitate to switch to organic farming due to concerns about lower yields and income loss. Extensive sensitization, education, and compensation for initial yield losses are necessary to encourage farmers to embrace organic practices.
- **Governmental support:** The government plays a crucial role in supporting organic farming through subsidies, infrastructure development, and farmer education. Creating awareness about the benefits of organic agriculture and implementing support systems can enhance market expansion.
- **Affordability of organic products:** Price-sensitive consumers in India often opt for cheaper alternatives, resulting in a smaller market for organic foods. Making organic products more affordable and price-competitive can increase their accessibility.
- **Retail challenges:** Retailers prioritize fast-moving, inexpensive products over organic alternatives due to uncertainties in the market. Organic brands need to offer greater incentives to retailers for shelf space, which can increase the cost of organic products.
- **Storage and shelf life:** Organic foods require specialized storage methods and have a shorter shelf life compared to conventional foods. This increases storage and preservation costs, posing challenges for organic farmers.
- **Balancing supply and demand:** The supply of organic food products is not evenly distributed, leading to gaps between consumer demand and availability. Strengthening local production clusters and bridging supply gaps can create a more balanced organic market.

To further promote organic agriculture, certain measures can be taken:

- Enhancing extension services to provide technical assistance and knowledge-sharing to farmers adopting organic practices.
- Investing in research and development to address organic farming challenges and develop location-specific methods.
- Developing robust market links, infrastructure, and price discovery mechanisms for organic products.
- Strengthening quality assurance and certification processes to ensure the credibility of organic goods.
- Integrating organic farming policies across sectors and ministries to create a comprehensive approach.

These measures can improve policy implementation, increase market potential, and advance the growth of organic agriculture in India.

## **19 Challenges and Barriers in Scaling up Organic Farming**

This section looks at the main difficulties and hindrances that organic farming encounters in India, from operational and technical issues to financial and market-related limitations. To successfully scale up organic agricultural practises, it is essential to recognise these obstacles and develop plans and regulations to address them.

### ***19.1 Knowledge and Technical Capacity***

The lack of knowledge and understanding of organic farming practices among farmers and stakeholders is a significant challenge. To address this, focused awareness initiatives, farmer training programs, and capacity-building efforts are needed to spread knowledge about organic farming practices, including soil fertility management, pest control, and post-harvest procedures.

Technical support and guidance are essential for the successful implementation of organic farming. However, there is a limited supply of agronomists, pest management specialists, and organic farming experts. Training programs and the development of qualified professionals can provide farmers with the necessary technical assistance to adopt and apply organic agricultural practices effectively. Research and development (R&D) play a crucial role in addressing technical challenges and knowledge gaps in organic farming. More research is needed on region-specific organic farming practices, natural pest control methods, and soil health enhancement. Collaborative research projects involving research organizations, educational institutions, and organic farmers can contribute to the development of technical knowledge and best practices in organic farming.

Promoting farmer-to-farmer information sharing networks can help bridge educational gaps in organic farming. Encouraging the creation of farmer-led organizations, organic farming groups, and community-based platforms can facilitate peer learning, information sharing, and the dissemination of best practices in organic agriculture. By sharing experiences and knowledge, farmers can become more technically literate and promote the adoption of organic farming methods.

### ***19.2 Infrastructure and Logistics***

To successfully adopt organic agricultural practices, farms need appropriate infrastructure for storage, processing, and irrigation. However, small and marginal farmers

often face challenges in accessing such infrastructure, which can lead to post-harvest losses and lower market value for organic crops. Investing in farm-level infrastructure development and providing financial assistance or subsidies for storage and processing facilities can enhance the effectiveness and efficiency of organic farming practices.

Establishing reliable certification and traceability procedures is essential for ensuring the integrity and legitimacy of organic products. This requires infrastructure for certifying organizations, sample analysis facilities, and record-keeping systems to monitor the entire supply chain from farm to market. Improving certification and traceability infrastructure can increase consumer confidence, facilitate market access, and support the growth of organic farming.

Efficient market access and infrastructure development are crucial for the advancement of organic farming. This includes creating specialized organic markets, as well as establishing processing, packaging, and cold storage centres. Insufficient specialized markets and logistics support can result in longer supply chains, higher transaction costs, and limited access to premium markets. Reducing post-harvest losses, improving market connections, and establishing effective organic supply networks can enhance the financial viability of organic agriculture.

Capacity development and training are necessary for all stakeholders in the organic product supply chain, including farmers, transportation workers, processors, and retailers, to address logistical challenges. Training programs can cover proper storage and distribution of organic products, maintaining quality during handling and transportation, and understanding organic certification and labelling requirements. Enhancing the capabilities of logistics service providers and increasing awareness of the unique needs of organic products can strengthen the overall logistics system for organic farming.

## 20 Market Linkages and Access

Establishing effective market connections and gaining access to high-end markets remain significant challenges despite the increasing demand for organic goods. Lack of specialized distribution networks, storage and processing units, and infrastructure for value-added services hinder the efficient distribution system for organic products. To address this, establishing specialized organic trade routes, cold-storage centres, and processing units can streamline the gathering, storage, and production of organic products, increasing market connections and accessibility for customers.

Price differentials and market fluctuations pose challenges for farmers in the organic sector (Bisht et al. 2020). Strategic marketing activities, consumer education, and raising awareness about the benefits of organic products can boost consumer demand and create a more stable and dependable market for organic producers. Certification and quality assurance play a crucial role in building consumer trust and maintaining market access for organic food. Simplifying the certification process, reducing

certification costs, and providing financial assistance or subsidies for organic accreditation can enhance farmer participation in organic marketplaces. Strengthening quality assurance systems, such as third-party authentication, residue evaluation, and compliance monitoring, can raise consumer confidence and improve market access for organic farmers.

Access to reliable and timely market information is essential for farmers to make informed decisions about production, pricing, and marketing strategies. Developing platforms for information exchange, farmer-centric market data systems, and market linkages between producers, aggregators, processors, and retailers can improve market transparency and empower farmers to make educated decisions.

Building strong value chains and market networks is crucial for linking organic farmers with customers and ensuring the efficient flow of organic goods. Contract farming, farmer-producer organizations, and partnerships can enhance interactions between stakeholders, facilitate direct market access, and reduce reliance on middlemen. Supporting the growth of inclusive value chains with both forward and backward linkages can help organic farmers capture a larger share of the value created in the supply chain.

## **21 Transitioning from Conventional to Organic Farming**

Farmers transitioning to organic farming require education and training in organic farming concepts, certification criteria, pest and disease control, and soil fertility management. Training programs and information sharing platforms can aid in a smooth transition. Restoring soil health through natural techniques and adopting integrated pest management strategies are crucial during the switch. Farmers need support in understanding pests and diseases and implementing preventive measures.

Market dynamics change during the transition, requiring farmers to understand consumer preferences, market demands, and certification standards (MoAFW 2018). Collaborating with organic customers, forming farmer groups, and exploring contractual arrangements can facilitate market access. Financial assistance in the form of funding, low-interest loans, and grants can help farmers manage the costs associated with the transition. Evaluating economic sustainability and providing financial literacy programs are essential.

## **22 Success Stories and Best Practices**

For the development and growth of sustainable agricultural practises, the success cases and best practises in organic farming offer insightful information and vital motivation. This section explores some well-known success stories and identifies

the crucial elements that were crucial to their success. We may use their experiences to inform future attempts to promote and expand organic farming practises by comprehending these examples of achievement and best practises.

## **23 Case Studies of Successful Organic Farming Models**

### ***23.1 Sikkim***

Sikkim, an Indian state in the northeast, has emerged as a pioneer in organic farming. By transitioning all agricultural practices to organic methods in 2016, Sikkim became the first fully organic state in India. The state's success can be attributed to strong political will, supportive legislation, and engaged farmers. Key initiatives included capacity-building programs, subsidized organic inputs, market linkages, and strict adherence to organic standards. Sikkim's organic farming model highlights the importance of government commitment, stakeholder participation, and a comprehensive policy framework (Kumar et al. 2018).

### ***23.2 Maragoli Farmer Cooperative Society***

The Maragoli Agricultural Cooperative Society in Karnataka demonstrates the benefits of collective effort and collaborative farming in organic agriculture. Comprised of marginal and small-scale farmers who have transitioned to organic methods, the cooperative has established an efficient supply chain for organic vegetables through resource pooling, knowledge sharing, and collective marketing. The cooperative focuses on market access, capacity building, farmer training, and quality assurance. The success of the Maragoli Farmer's Cooperative Society underscores the significance of cooperation, knowledge exchange, and group marketing strategies for small-scale organic producers (Kareemulla et al. 2017).

### ***23.3 Dharmapuri Organic Farmers Association***

The Dharmapuri Organic Farmers Association in Tamil Nadu is recognized for its innovation in organic farming, particularly in paddy cultivation. The association promotes the System of Rice Intensification (SRI), an organic rice cultivation technique that emphasizes water management, soil health, and natural pest control. Through farmer-to-farmer mentoring, training programs, and knowledge exchange, the association supports farmers in adopting SRI and organic farming methods. Farmers using SRI and organic practices report higher yields, lower production

costs, and improved soil health. The accomplishments of the Dharmapuri Organic Farmers Association highlight the importance of farmer-led initiatives, context-specific approaches, and sustainable rice production techniques in organic farming (Rajendran et al. 2016).

### ***23.4 Innovative Approaches and Lessons Learned***

Zero Budget Natural Farming (ZBNF), pioneered by Subhash Palekar, is a regenerative approach that promotes natural farming techniques with minimal external inputs. It emphasizes the use of indigenous microorganisms, cow dung and urine, mulching, and intercropping to improve soil fertility, reduce costs, and enhance crop resilience. Valuable lessons from ZBNF include harnessing local resources, promoting soil health, and minimizing reliance on external inputs for sustainable agriculture (Sobhana et al. 2019).

Community-supported Agriculture (CSA) establishes direct connections between farmers and consumers. Consumers subscribe to a share of the farm's produce, providing upfront support to farmers and receiving regular supplies of fresh, organic food. CSA fosters transparency, trust, and shared risks and rewards. Lessons from CSA include building direct links between farmers and consumers, engaging the community, and creating a reliable market for farmers (Woods et al. 2017). Permaculture integrates ecological principles and sustainable farming practices to create self-sustaining systems. It employs techniques such as companion planting, agroforestry, water harvesting, and soil conservation. Valuable lessons from permaculture include designing resilient farming systems, optimizing resource utilization, and enhancing ecosystem services for sustainable agriculture (Mollison et al. 1991).

## **24 Replicability and Scalability of Best Practices**

Replicability and scalability of successful organic farming models depend on knowledge exchange among farmers, adapting practices to local contexts, strong policy support, and collaboration between stakeholders. Sharing successful practices through farmer field schools, demonstration plots, and community-based training programs promotes peer learning and capacity building.

Adapting best practices to local agro-climatic conditions and resources increases their likelihood of success and wider adoption. Flexibility and tailoring strategies to specific contexts enhance replicability. Supportive policies, including incentives, subsidies, and technical assistance, encourage farmers to replicate successful practices on a larger scale. Dedicated institutions like agricultural extension services and research organizations provide guidance and resources. Collaboration and partnerships between stakeholders, including public–private partnerships, leverage collective strengths to facilitate knowledge transfer, resource mobilization, and market

access. These collaborations bridge gaps in knowledge, technology, and market opportunities, supporting the replicability and scalability of best practices.

## **25 Future Directions and Recommendations**

As the organic farming sector in India progresses, it is crucial to envision future directions and offer recommendations for its continual advancement and improvement. This section highlights potential areas of expansion, emerging trends, and essential suggestions to ensure the sustainable and successful growth of organic agriculture in the years ahead. By identifying opportunities and addressing challenges, we can shape the future trajectory of organic farming in India, fostering a resilient and environmentally conscious agricultural system.

## **26 Research and Innovation in Organic Farming**

Research and innovation are vital for advancing organic farming in India. Research on soil health and nutrient management can improve fertility and nutrient availability through biofertilizers, vermicomposting, and green manuring. Effective pest and disease management can be achieved through research on biological control, biopesticides, and ecological pest management approaches. Agroecology and crop diversification research can promote resilient and sustainable farming systems by exploring biodiversity, ecological intensification, and diverse cropping strategies (Sullivan et al. 2003). Integrating technology and digital solutions, such as precision agriculture and online platforms, can streamline operations and facilitate knowledge dissemination. Research efforts should focus on developing context-specific technologies to empower farmers and enhance the efficiency of organic farming practices.

## **27 Strengthening Extension Services and Knowledge Dissemination**

Strengthening the capacity of extension workers through training programs, continuous professional development initiatives, and knowledge-sharing platforms is crucial to effectively support organic farmers. Utilizing innovative communication channels, including digital platforms, radio, and television, enhances the dissemination of organic farming knowledge to a wide range of farmers. Promoting farmer-to-farmer knowledge exchange through farmer field schools, study circles, and local farmer groups facilitates peer learning and sharing of best practices. Encouraging

participatory research and on-farm trials involving farmers, researchers, and extension workers allows for collaborative learning and the co-creation of knowledge tailored to organic farming contexts. By empowering extension workers and facilitating knowledge exchange, we can accelerate the adoption and success of organic farming practices.

## **28 Enhancing Market Infrastructure and Linkages**

Consumer education and awareness campaigns are essential for increasing demand for organic products. Promoting the benefits of organic farming, highlighting the environmental and health advantages, and raising awareness about organic certification and labelling can enhance consumer trust and willingness to choose organic products (MoEFCC 2018). Education initiatives can include workshops, community outreach programs, and consumer guides that provide information on organic farming practices and the importance of supporting organic agriculture.

Leveraging technology and digital platforms can expand market reach and facilitate direct connections between organic farmers and consumers. Online marketplaces, e-commerce platforms, and social media channels enable farmers to showcase their products, reach a wider consumer base, and engage in direct marketing. Utilizing digital tools for traceability and transparency, such as blockchain technology, can enhance product integrity and build consumer confidence in organic products (Hamzaoui et al. 2012).

Promoting regional and international trade of organic products can provide new market opportunities for organic farmers. Participating in organic trade fairs, exhibitions, and networking events allows farmers to connect with potential buyers, distributors, and importers. Developing organic export strategies, complying with international organic standards, and establishing partnerships with certification bodies can facilitate access to global markets and improve the competitiveness of Indian organic products. In summary, developing market infrastructure, conducting market research, fostering market linkages, implementing supportive policies, promoting consumer education, leveraging technology, and exploring regional and international trade opportunities are key strategies to strengthen the organic farming sector and ensure its long-term sustainability and growth.

## **29 Policy Recommendations for Promoting Organic Farming**

Implementing strict regulations and standards for organic certification is crucial for maintaining the integrity of organic farming and instilling consumer confidence. Governments should establish robust certification bodies and accreditation processes



to ensure that organic products meet the required standards (Barik et al. 2017). Regular inspections, testing, and verification should be conducted to prevent fraud and maintain the authenticity of organic products. Additionally, promoting transparency in the certification process and providing clear labelling guidelines can help consumers make informed choices and support organic farmers. Collaboration between different stakeholders, including farmers, policymakers, researchers, and consumer organizations, is essential for the growth and development of the organic farming sector. Creating platforms for dialogue and engagement, such as organic farming associations, industry networks, and stakeholder forums, can facilitate knowledge exchange, address challenges, and foster collective decision-making. Engaging farmers in policy development processes and incorporating their perspectives and experiences can lead to more effective and farmer-centric policies for organic farming. Finally, raising awareness and promoting the benefits of organic farming among consumers and the general public is crucial. Governments can invest in public awareness campaigns, educational programs, and promotional activities to highlight the advantages of organic products for human health, the environment, and sustainable agriculture. Encouraging partnerships between organic farmers and local communities, schools, and restaurants can create direct connections and build trust, further boosting demand for organic products. In conclusion, providing incentives and financial support, investing in research and development, building capacity, creating a supportive market environment, ensuring strict certification standards, fostering collaboration, and raising awareness among consumers are all key strategies for policymakers to promote and strengthen the organic farming sector. By implementing a comprehensive and holistic approach, governments can foster the transition to organic farming, support farmers, and contribute to sustainable and resilient food systems.

### **30 Conclusion**

In summary, the chapter has provided a thorough investigation of the advantages and obstacles linked with organic farming techniques in India. Within the confines of this chapter, we have deeply examined the intricate aspects of organic farming, underscoring its capacity to transform the agricultural vista while simultaneously tackling significant issues relating to well-being, durability, and economic feasibility. In addition, the cultivation of organic crops promotes biodiversity, resulting in healthier ecosystems and increased resistance to pests and diseases. The adoption of organic practices by farmers offers the opportunity to curtail their dependence on synthetic inputs, mitigate environmental harm, and preserve crucial natural resources. Furthermore, the cultivation of organic crops facilitates biodiversity, resulting in healthier ecosystems and heightened resistance to pests and diseases. The chapter has emphasized the crucial significance of organic farming in augmenting human health and overall welfare. By eradicating the employment of detrimental pesticides

and chemicals, organic crops provide consumers with a more secure and wholesome range of food alternatives. Researches have demonstrated that organic fruits, vegetables, and grains consist of elevated amounts of vital nutrients and reduced quantities of harmful residues, rendering them an astute preference for individuals who are health-conscious. Moreover, the social and economic facets of organic agriculture have been duly considered, recognizing its capability to empower small-scale farmers and foster inclusivity in the agricultural industry. Although the adoption of organic farming techniques may pose difficulties, especially for farmers lacking in resources, this chapter has identified several approaches and support mechanisms that can facilitate this transition and promote the accessibility of organic inputs.

As such, the achievement of organic farming's complete potential in India necessitates a combined exertion from all stakeholders, including policymakers, farmers, consumers, and the private sector. Critical strides in cultivating its growth include the implementation of policies that both incentivize and support organic agriculture, funding research and development to enhance organic farming techniques, and increasing consumer awareness of the advantages of organic produce.

Further investigation is necessary to assess the enduring impacts of organic farming, encompassing its implications on soil health, preservation of biodiversity, and provision of ecosystem services. Comparative analyses of productivity and crop yield in organic farming systems can aid in the identification of optimal techniques for maximizing productivity while ensuring sustainability. Research on the contribution of organic farming to resilience against climate change is imperative, including its efficacy in carbon sequestration, water management, and adaptation strategies. Detailed economic evaluations and market studies are essential to appraise the economic feasibility and profitability of organic farming. An understanding of the perception and behaviour of consumers towards organic products can help in the formulation of marketing strategies and targeted awareness campaigns. The exploration of technological innovations relevant to organic farming, such as precision agriculture and alternative pest management approaches, can augment efficiency and sustainability. Addressing these research gaps will lead to a more comprehensive comprehension of organic farming and enable its further development in India.

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