

Organic Farming in India and its Way Forward

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ABSTRACT

India is home to 30% of the world's organic growers and is likely to expand in the coming years. The solution to the issues of sustainability, global warming, land degradation and food security is Organic Farming, which is seen as a sign of dynamic change for the agricultural industry. Organic Farming discards the use of synthetic fertilizers and promotes sustainable agricultural practices. Organic Farming holds immense potential to revive the degrading state of the agricultural sector in the world by offering environmental benefits, quality products and conserving non-renewable resources. It is a promising alternative to conventional farming and is expanding quickly. Organic Farming is gaining worldwide attention with 2.30 million hectares of land being used for the purpose. It helps to reduce greenhouse gas (GHG) emissions and improves soil fertility, boosting productivity and crop health. Organic Farming can also be used for land reclamation purposes. The aim of the present study is to examine the development of Organic Farming in India and globally, as well as identify any potential barriers to its implementation.

Keywords: Agriculture; Sustainability; Organic farming; Pesticides; Land degradation

1. INTRODUCTION

India derives 20 percent of its GDP from agriculture, with 66.6 percent of India's population being dependent on it for their livelihood. Over the last 30 years, cropping intensity has increased from 118 percent to 135 percent¹. Due to the expansion of agriculture, arable land is rapidly decreasing. The most significant barrier is the excessive consumption of chemical fertilizers, causing soil quality to degrade over time and thus be harmful in the long term. Another important aspect is land degradation due to anthropogenic activities such as mining which disrupts the soil and nearby land. Reclamation of such areas is highly recommended, especially in India, a major player in the mining sector.

To remedy this alarming situation, organic fertilizers are highly recommended. However, the availability and adoption of Organic Farming in India are low. These nonchemical options are critical for the agricultural transition to a sustainable farming practice but are expensive due to their low cost compared to chemical fertilizers². Organic Farming is an eco-friendly technique that originated due to the adverse effects of chemical fertilizers. Organic Farming holds immense potential to revive the degrading state of the agricultural sector in the world by offering environmental benefits, quality products and conserving non-renewable resources. It not only helps to sustain the soil and ecosystem but also improves the health of producers and consumers³.

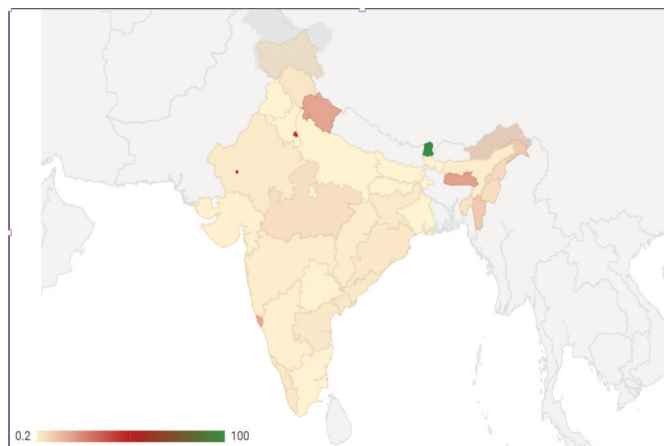


Figure 1. State-wise organic coverage in India (net sown area percentage) Data Source: apeda.gov.in

Organic Farming is an amalgamation of innovation and science to promote a sustainable relationship between plants, wildlife, and humans⁴. They help promote a balanced supply of nutrients, keeping the plants healthy, enhancing soil biological activity and nutrient mobilization in the soil. Due to Organic Farming practices, there has been an increase in the soil water retention capacity and a decrease in the acidity and salinity of soil. Organic Farming also helps to supply food for microorganisms and earthworms beneficial for soil fertility. Organic fertilizers have a low nutrient content and are required in large amounts to work effectively. This might lead to nutrient deficiency due to slow nutrient release to meet the crop

requirements. The cost of pursuing Organic Farming is very high compared to chemical and conventional farming resulting in its slower growth and adoption amongst farmers. Figure 1 depicts the current progress of the Indian states under Organic Farming. With 35% of its poor population, Sikkim was long regarded as one of India’s poorest states and became the first organic state in the world⁵. Going entirely organic was not an easy transition for Sikkim. On the high, terraced slopes of the Himalayas, there were countless small farms. The 66,000 farmers in the state received agroecological farming instruction and a robust policy framework from the state government⁶. Many harvests failed in the first few years, which reduced agricultural output. The rapid removal of synthetic fertilizers from the soil necessitated many years for the earth to regain fertility. Ladakh, Meghalaya, Uttarakhand, and Goa follow this.

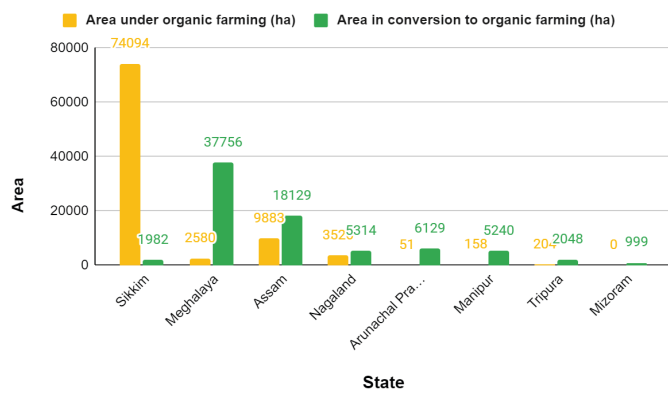


Figure 2. Area under organic cultivation and area in conversion to organic farming of North Eastern States (from 2017-18) (Source: apeda.gov.in).

Farming practices in North East India have traditionally been organic, using little chemical fertilizers (Fig. 2). Islands and tribal territories are now getting developed to maintain their biological history. India owns 26% of certified land under cultivation and 74% of the forest area, making it ranked 9th in terms of area under Organic Farming. With 585200 producers and 0.7% organic share, Madhya Pradesh and Uttar Pradesh are the greatest regions covered under Organic Farming, followed by Sikkim, which is recognized as a fully organic state as it completely disregards the usage of chemical fertilizers⁷. India has one of the largest organic wild harvest collections. More than 1.34 million metric tonnes of highly attested organic products, comprising all types of food items, which are consumable and non-consumable, were produced in India in the years 2015 and 2016⁸.

Table 1. Organic products exported from India

Product Type	Organic Produce
Cereals	Wheat, Rice, Maize or Corn

Pulses	Red gram, Black gram
Fruits	Banana, Orange, Mango, Pineapple, Passionfruit
Oil and Seeds	Soyabean, Sunflower, Mustard, Groundnut, Cotton Seed
Vegetables	Brinjal, Garlic, Potato, Tomato, Onions
Herbs and Spices	Chilli, Peppermint, Cardamom, Turmeric, Black Pepper, Amla, Ginger
Others	Jaggery, Sugar, Tea, Coffee

Source: Chandrashekar 2010

Furthermore, the Agri-export Policy 2018 asserts the country is a potentially significant player in the world organic market. According to government estimates, India’s top organic exports include flax seeds, sesame, soybean, tea, medicinal plants, rice, and pulses (Table 1), expanding India’s organic exports by about 50% in 2018–19, reaching Rs 5,151 million⁹.

This study aims to understand the history of Organic Farming in India and the world through various scientific literature and draw inferences about Organic Farming’s potential growth in the country. Organic Farming is slowly gaining pace in India and is becoming widespread. However, Organic agricultural methods are unknown to the local farmers, who favor traditional agriculture, which yields goods faster by utilizing poisonous chemical pesticides and fertilizers, affecting human health and the environment. Awareness-raising initiatives should be planned to increase the practice of Organic Farming so that farmers may learn about Organic Farming and its benefits. The ultimate goal is to evaluate the factors which may facilitate the adoption of Organic Farming in the country and provide recommendations to expedite the adoption of organic agriculture in India¹⁰.

Based on scientific literature and reports on Organic Farming practices at the Global and Indian levels, a thorough literature review was carried out. Most studies seek to minimize extraneous variations such as soil type, geographic location and living standards with different degrees of success. We further read and researched case studies to understand the real-life impact of Organic Farming on countries. China and Sri Lanka have been chosen to show contrasting viewpoints on the advantages and disadvantages of Organic Farming and to emphasize formulating an accurate action plan for India. The study concludes by identifying potential challenges of expanding Organic Farming in India and providing a long-term and short-term implementation plan to expand Organic Farming culture in India with strengthening governmental policies and support.

2. INTERNATIONAL STATUS OF ORGANIC FARMING

Lockeretz, *et al.* (1987) compared the economic performance of 14 organic crop/livestock farms in the Midwest to that of 14 conventional farms¹¹. The farms

were linked based on the physical characteristics and different types of agricultural operations. Organic farms' market value of the crops produced per unit area was 11% lower. But, because the cost of production was also lower, both systems had equivalent net revenue per unit area. The net returns on organic farms were often more. According to both research, organic farms had reduced production costs.

The yield of the organic movement is a frequent topic of inquiry. Can Organic Farming feed everyone on the planet? Even high-input, high-yield systems are now failing to feed the globe due to problems with food distribution, social organization, and grave concerns about poverty, racism, and gender¹². Less food will be available if the land is converted from inorganic to Organic Farming because of yield losses during the conversion phase. Such organically grown food is only purchased by the wealthy. As a result, less food is accessible to the poor. The price of the food they can buy goes up. Issues with equity result from this. Despite all of this, Organic Farming is effective. Some research showed sustained yields (albeit somewhat lower in many years) without agrochemicals in temperate climatic conditions based on tests running for 25 years in Switzerland. On the other hand, many agricultural experts think that large amounts of farm yard manure (FYM) and other biomass material, which will be required to make up for the fertilizers, are inaccessible without chemical fertilizers. Moreover, they think that some crops need the help of agrochemicals, particularly fertilizers to achieve greater output yield-wise and that adopting Organic Farming results in food insecurity for the nation¹³.

Darnhofer (2010) noted that consumer tastes shifted towards chemical-free organic foods¹⁴. Organic Farming has spread to 187 nations, with 3.1 million farmers managing 72.3 million hectares of land. Australia (35.69 mha) has the highest amount of organic land, followed by Argentina (3.63 mha) and Spain (2.35 mha)¹⁵. All areas have seen growth in organic agricultural land and retail sales. Organic Farming is a promising sector with immense potential to grow and revolutionize the global agricultural industry.

Due to its numerous advantages, Organic Farming has become globally popularized as a propitious alternative to conventional agriculture. Since 2000, there has been a prominent rise in the overall Organic Farming production area, especially in industrialized countries¹⁶. Oceania accounts for approximately half of the world's farmed land with an estimated 35.9 million hectares (mha) of Organic Farming, followed by Europe (14.6 mha), South America (8 mha), Asia (6.1 mha), North America (3.2 mha), and Africa (3.2 mha).

Figure 3 depicts the Top 10 countries for Organic Farming in Asia. China has an Organic Farming land area of 1,90,000 hectares and is the fourth largest consumer of organic goods. Under arable and permanent crops, oil seeds, coconuts, cotton, coffee, temperate fruits, and tea make up the majority of the organic output

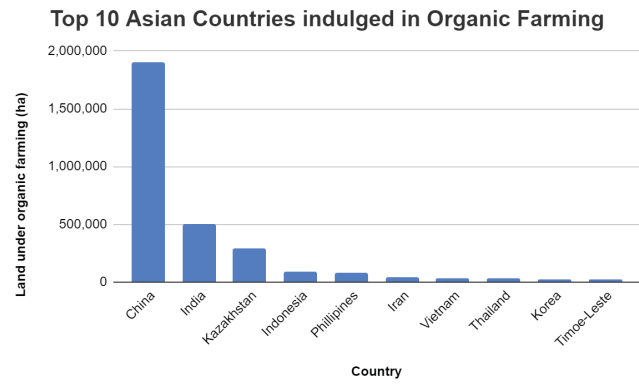


Figure 3. Top countries for organic farming in asia [Source: USDA] (Source: agricoop.nic.in)

in Asia. In 2015, 5.5 million hectares of wild organic agricultural land was used for growing fungi produce, medicinal plants, and oil¹⁷. In 2015, organic food sales in Asia, Australia, and other areas totaled 7.2 billion US dollars, boosting Asia's export market. The key nations with the highest sales of domestic organic products are South Korea, Taiwan, Japan, Malaysia, and Singapore¹⁸.

3. STATUS OF ORGANIC FARMING IN INDIA

According to Tambe 2020, Organic Farming is a labor-intensive procedure that is highly restricted to farmers with abundant resources and the export market. It relies on external support systems for the price, market data, and product certification. As a result, he has concluded that Organic Farming likewise has a narrow area of application and societal value. Instead, he has advocated ecological farming; the major goals are maintaining high output, lowering production costs, and increasing self-sufficiency¹⁹. Both resource-poor and resource-rich farmers may benefit from it. The method is straightforward, it targets local markets, and its scope of coverage and social significance are decently high.

According to the Ministry of Agriculture and Farmers' Welfare, in 2020-21, 0.98 million farmers were brought under Organic Farming. Under the schemes, about 0.94 million ha area in India is under Organic Farming. The Government of India has been consistently promoting the country's chemical-free farming practices through dedicated schemes since 2015. Schemes such as PKVY and MOVCDNER provide end-to-end support to farmers in establishing, certifying and marketing the Organic Farming practice on their land²⁰. However, Organic Farming production has been volatile, as seen in Table 2. The amount spent on schemes and programmes to promote Organic Farming is dwarfed by the annual subsidy provided on chemical fertilizers²¹.

Table 2. Growth of organic farming in India over the years

Year	Organic Farming Area (Hectares)	Organic Production (MT)*	No. of Farmers
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2015-16	19281	6321661	19355
2016-17	96291.16	8760811	173846
2017-18	6455	17132676	84618
2018-19	124990	989255	166571
2019-20	222369	2047536	365253
2020-21	7568	3399520	12074

Source: NCOF report; *MT- Metric Tonnes

There has been a rapid decrease in organic fertilizer production in India from 338720 million tonne in 2017-18 to 3879 million tonne in 2020-21. The possible reasons could be the organic fertilizer industry is hampered by low and uncertain demand, which prevents it from using its capacity optimally and discourages additional investment. Duplicity in securing licenses and official permission for manufacturing, selling, and quality testing of organic fertilizers hinder the manufacturing, selling, and quality testing of organic fertilizers. Using organic fertilizers and on-farm inputs can take time and resources compared to using chemical fertilizers²². A minimal financial allocation has been set out in public research institutes for organic fertilizer research and development.

Drylands that are semiarid and arid, on various occasions, have inadequate organic matter and water-holding ability²³. Soil fertility is declining and certain serious pests are developing a resistance to synthetic pesticides in many areas where heavy input agricultural systems are used²⁴. Many of these are signs of inefficient land use, which contributes to desertification; adopting Organic Farming techniques suited for drylands can assist in improving these situations.

4. ORGANIC VS CONVENTIONAL FARMING

Organic agriculture varies fundamentally from conventional agriculture. Thus, the ongoing use of Organic Farming practices appears to change the agro-functioning ecosystem. Organic farms typically support 30% more biodiversity than traditional farms. Even while conventional farming consistently adheres to some ecological principles, Organic Farming tends to increase soil fertility in a way that conventional farming cannot²⁵. One approach to sustainable agriculture is Organic Farming. Many of these techniques utilized crop rotation, intercropping, mulching, double digging, and crop integration²⁶.

Figure 4 explains the existing drawbacks of conventional farming, emphasizing why there must be a significant shift to Organic Farming from conventional farming. Health consciousness and public readiness to pay for expensive organic goods are the main variables affecting consumer demand for organic food. Organic products have a rich, health-conscious customer base driven by a liberal price premium and environmental concerns²⁷.

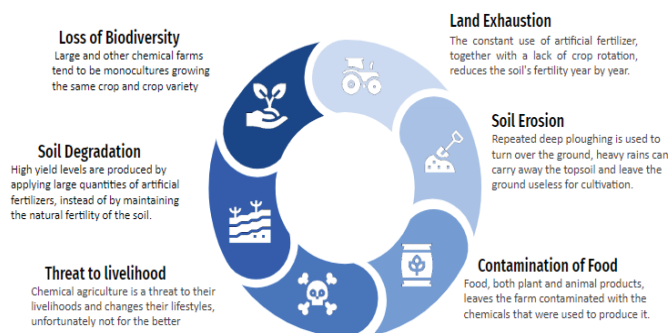


Figure 4. Bottlenecks of conventional farming

The literature research has demonstrated differences in viewpoints on Organic Farming, particularly among specialists. Although there is much disagreement on the profitability and yield growth of Organic Farming, there is broad agreement regarding its potential to safeguard human health and preserve the environment. Studies testify that Organic Farming is environmentally friendly. Still, there have been fewer efforts to promote Organic Farming in the form of subsidies, training facilities, etc., compared to conventional farming. This drawback can be addressed with the right incentives and policies. India, particularly in the dryland areas of the nation, may benefit from the varied soil and climatic conditions.

5. POLICIES FOR ORGANIC FARMING IN INDIA

Some initiatives the Ministry of Agriculture and Farmers Welfare took to promote Organic Farming in the country and equip farmers with the proper knowledge and skills are mentioned in Table 3²⁸.

In order to develop a plan of action for Organic Farming implementation in India, it is essential to study the growth and failures of other countries and learn from their methods. The prime focus of this section is to scrutinize the past experiences of India's neighbouring countries - Sri Lanka and China's approaches to Organic Farming, as well as the key actions that have been made to ensure the success or failure of this type of farming.

6. THE SRI LANKA CASE

In 2021, the President of Sri Lanka, Gotabaya Rajapaksa, decided to stop the import of chemical fertilizers and pesticides. Due to this, Organic Farming was picked up by all Sri Lankan farmers, and then the devastating effects ensued³⁶. According to a source, Sri Lanka's president Gotabaya Rajapaksa planned to save \$400 million yearly on chemical fertilizers and pesticides. Along with this, the president believed that using chemicals in agriculture affected the health of humans and the environment. Once independent in rice production, the country spent \$450 million on its imports. The ban reduced production by 20% in six months³⁷. Due to this reason, Sri Lanka saw a decrease in its output

Table 3. Policies to promote organic farming in India

Paramparagat Krishi Vikas Yojana (PKVY)	The PKVY started in 2015 to encourage cluster-based Organic Farming through a participatory guarantee system for India. The Bhartiya Prakritik Krishi Paddhati, based on principles of natural farming, was included in the PKVY as a sub-scheme in 2020–21. The National Mission on Clean Ganga (NMCG) has also been made part of PKVY ^[29] .
Mission Organic Value Chain Development for North Eastern Region (MOVCDNER)	With a vision to establish certified organic production in a sustainable value chain, the scheme has helped to connect farmers with customers since 2015. They aim to create a sustainable value chain from the input of seeds to establishing facilities for aggregation, processing and marketing of organic products via brand-building initiatives ^[30] .
One District-One Product (ODOP)	It was initiated in 2018 and the program uses the One District One Product (ODOP) strategy to leverage scale in input procurement, shared services, and product marketing. In districts, there could be more than one cluster of ODOP products ^[31] .
National Policy for Farmers, 2007	This strategy supports farmers' adoption of Organic Farming and highlights its significance. It supports using organic inputs and traditional knowledge for sustainable agriculture and offers incentives for Organic Farming ^[32] .
National Program for Organic Production (NPOP)	It is an Indian certification scheme for organic goods. The program specifies requirements for organic cultivation, certification, and body accreditation. In India, NPOP certification is a requirement for all organic ^[33] .
Sikkim Organic Mission	The first entirely organic state in India is Sikkim. The Sikkim Organic Mission was established in 2010 to make all of the state's agricultural land organic. Farmers that embrace organic agricultural methods receive incentives and subsidies from the state government ^[34] .
Karnataka State Organic Farming Policy	The Karnataka State Organic Farming Policy was introduced in 2017 to elevate Organic Farming practices in the state. The policy aims to promote Organic Farming practices and increase the area under organic cultivation in the state. It encourages farmers to adopt Organic Farming practices through awareness campaigns, capacity building, and financial incentives ^[35] .

of crops by 18%. The Sri Lankan government had to spend a lot of money in the form of subsidies to help the farmers cover up for this loss in productivity.

7. THE CHINA CASE

China is rated 3rd internationally in certified organic products and 4th globally in sales. In China, organic food production and sustainable agricultural methods are increasing, based on a government study from 2019. Between 2005 and 2018, the total area under cultivation for certified organic agriculture expanded more than five times to 3.1 million hectares³⁸. China exports agri-food products worth US\$65 billion annually. With various forms of official assistance, farmers are abandoning using chemicals in their agriculture to promote and advance individuals' health, environmental preservation, and economic motivations. Chinese customers are eager to eat food without chemicals, mainly for health reasons. Organic and "green" food demand is rising quickly, particularly among the middle and upper classes³⁹.

8. INFERENCE FROM THE CASES

Chemical fertilizers and pesticides considerably affect the health of humans and the environment. This was the primary reason for the ban, but it is also important to

realize that these chemicals allowed the farmers to grow more crops on a smaller piece of land. This quality of chemicals that enable the farmer to produce higher yields is a huge plus in upcoming nations like Sri Lanka. In 2000, 83% of Sri Lankan population was categorized as nourished. However, in 2019, the population of Sri Lankans who were nourished was just 7%. At the same time, China has made significant research investments and has institutions supporting the organic industry that offers training and information sharing. Twenty-one million farmers were taught soil, water, and fertilizer management. This initiative increased maize, wheat, and rice yields by 11% while reducing nitrogen fertilizer consumption by 15% to 18%.

The Chinese experience has been innovative in that it has established a local standard, the Green Food standard, and has spread, tested, and refined it away from the international spotlight. It has also differentiated certification into Grade A and Grade AA. This tactic has aided in China's quick adoption of organic foods. While the Chinese gradually acclimated the farmers towards Organic Farming through flexible and lucrative policies, the sudden policy shift in Sri Lanka and the lack of a concrete supply chain system led to the downfall of the economy and the environment in Sri Lanka.

9. CHALLENGES IN ORGANIC FARMING

India can learn from other countries' successes and mistakes in expediting the Organic Farming development process. To implement an effective action plan, it is necessary to identify potential challenges which may be a roadblock to Organic Farming expansion in India.

9.1 Shortage of Biomass

Many erudite scholars and experienced farmers are skeptical about the nutrient value that organic fertilizers could impart. Researchers believe this organic matter is not enough to be accessible to all.

9.2 Disparity of Supply and Demand

Fruits and vegetables cannot be grown or moved to any area like non-perishable grains can, yet non-perishable grains can be cultivated anywhere. It ought to be produced close to the demand, and there ought to be willing businesses and farmers there. However, the demand mostly originates from urban areas where no farms can grow organic fruits. The solution to this smart transfer is through experienced routes.

9.3 Time

More interaction between a farmer and his crops is required in Organic Farming, such as weed control, early intervention, and crop monitoring. With conventional techniques and chemical fertilizers, the time taken to produce more crops is less.

9.4 High MRP

Organic Farming is cost sensitive due to the extreme care needed in its practice, as a result their cost of production is also high. This leads to customer segmentation, mostly the rich and environmentally conscious people would buy organic products which hinders its expansion over the country.

9.5 Lack of Special Infrastructure

Handling organic produce is a very necessary step in expanding and flourishing the organic farming industry in the country. Due to lack of infrastructure and facilities there is massive spoilage which is a major challenge.

10. APPLICATION OF ORGANIC FARMING IN LAND RECLAMATION

India accounts for 16% of the global population, although its land only covers 2% of its total area. Naturally, the soil is sometimes under more stress than it can handle. As a result, India's productive resources, particularly its agricultural land, are constantly undergoing varying degrees of deterioration and are quickly becoming a wasteland. In India, there are currently 68.35 million hectares of wastelands on the planet. About 50% of these areas are non-forest lands of this type, which, with the proper care, may be restored to fertility⁴⁰. The chemical

and physical functions of the soil, such as sorption capacity, nutrient mobilization, and long-term fixation, are all improved by organic additions. Organic matter improves soil quality and serves as a store for nutrients, preventing nutrient loss through leaching and erosion.

Green manures act as mulch for the soil, protecting it from moisture loss and wind/water erosion and increasing the soil's organic matter. Nitrogen-fixing bacteria of their root nodules aid in absorbing nitrogen from the atmosphere. Land Remediation Techniques cover methods like composting and farming on land. Inland farming, polluted soils are transported to farming locations where they are repeatedly turned over and tilled to provide for aeration. The government or local authority concerned must provide financing or approve large-scale, expensive soil remediation projects⁴¹.

11. SOCIO-ECONOMIC IMPACT THROUGH ORGANIC FARMING

Because Organic Farming needs more effort, each farm creates more employment that generates cash. Their occupational health is enhanced since farmers and laborers on organic fields are less likely to be exposed to agriculture-related chemicals⁴².

Organic produce is healthier and more durable due to low nitrate and high levels of antioxidants which assist in extending their shelf life⁴³. The industry is experiencing a boom in the economy due to increased profits generated by Organic Farming. The idea of industry-driven "One district - One product" is now being encouraged, as is the creation of new clusters close to larger towns where the demand for organics will be considerably greater. By eliminating synthetic fibers and carbon sequestration, Organic Farming can also help lower emissions and the atmospheric carbon dioxide level⁴⁴.

The second aspect impacting farmer inclination towards Organic Farming is perceived benefit. An individual is more open to adopting new behavior the larger its benefits. Farmers are more likely to use Organic Farming if they believe that cultivating organic crops would minimize crop disease and produce better harvest quality yielding more profits.

12. THE ANNUAL BUDGET OF INDIA 2023

The government would help 10 million farmers switch to natural (or chemical-balanced) farming during the following three years, according to Budget 2023. The budget initiated a PM PRANAM program for the restoration, awareness, nutrition and improvement of Mother Earth. The increase in soil health in India is one of the main advantages of natural farming. In traditional agriculture, the misuse of synthetic fertilizers and pesticides can degrade the soil, lowering its fertility and capacity to sustain strong plant development⁴⁵.

The livelihoods of Indian farmers may potentially be improved through natural farming. Natural food is frequently more expensive than traditionally produced, giving farmers better incomes and more stable living

<p>1. Research and Development</p> <p>There must be investment in building capacity and training small-scale manufacturers and entrepreneurs on composting techniques, quality assurance, and marketing and selling manure to upscale production.</p>		<p>4. Smoother On-Boarding Process</p> <p>Farmers are very poor and are largely unable to afford the cost of certification programs. Promoting certification as a universal requirement of organic farming has thus had a negative impact on its adoption by smallholders in these areas.</p>	
<p>2. Policies and Schemes</p> <p>A targeted, ambitious and well-funded nationwide programme must be developed. Quality of organic fertilizers must be ensured by developing a robust monitoring and enforcement mechanism in collaboration with center and states across the country</p>		<p>5. Technological Advancement</p> <p>Usage of drones and artificial intelligence to develop better technologies would help to curb the gap between slower yield of organic farming and an environmental friendly approach. They also help to increase soil fertility while optimizing yield in the era of digitalization.</p>	
<p>3. Raising awareness</p> <p>Farmers should be mobilized and trained to produce on-farm inputs through farmer-field schools, using information and communication tools, regular hand-holding, interaction with a pool of experts, mainstreaming best practices, and exposure visits.</p>		<p>6. Supply Chain Management</p> <p>Local, decentralized production of all inputs for organic farming should be encouraged not only so that local resources can be utilized but also so that village-level employment can be generated. Locally produced inputs are also much less likely to be adulterated.</p>	

Figure 5. Strategies to promote organic farming in India.

conditions. Natural farming can also lower the danger of crop failures since organic farmers use a variety of crops, which lowers the chance of crop failures brought on by pests and diseases⁴⁶.

13. RECOMMENDATIONS

13.1 Strategies to promote Organic Farming in India

After analyzing the scenario of Organic Farming in Sri Lanka and China, we feel it would be in India’s best interest to adopt the following practices and develop a comprehensive action with both long-term and short-term strategies explained in Figure 5 and 6.

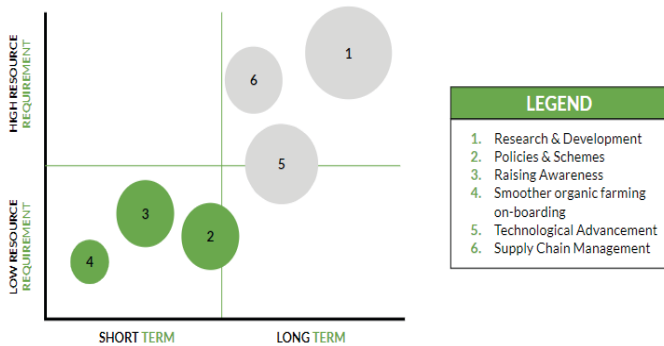


Figure 6. Long-term and Short-term map to implement strategies.

This chart bifurcates the above-mentioned strategies into long-term and short-term implementation goals. The size of these bubbles is directly proportional to the expected impact, while the color represents the priority of the steps mentioned above. Green bubbles are recommended for immediate implementation, while grey bubbles depend on government budgetary constraints.

14. CONCLUSION

Organic Farming is an amalgamation of innovation and science to promote a sustainable relationship between plants, wildlife, and humans. They are beneficial to the environment and increase the quality of life by producing

healthier products. Organic Farming also helps to supply food for microorganisms and earthworms beneficial for soil fertility. The sector is pacing up with time and has spread to 187 nations, with 3.1 million farmers managing 72.3 million hectares of land. Despite being a consumer-centric and market-controlled sector, the organic industry has expanded to approximately 30% annually over the past ten years. The government is taking relevant measures to promote Organic Farming in India through multiple schemes and policies. However, organic agricultural methods are unknown to the local farmers, who favor traditional farming, which yields goods faster using poisonous chemical pesticides and fertilizers. Awareness-raising initiatives should be planned so that farmers can learn about Organic Farming and its benefits. It can be used in land rehabilitation practices across the country and help to reclaim barren land by improving soil quality and serving as a store for nutrients, preventing nutrient loss through leaching and erosion.

However, there is a need to create the right technology and infrastructure to distribute the farmers. Farmers must receive training in value-added technologies. India must learn from the cases of Sri Lanka and China and focus on prioritizing Organic Farming by addressing the existing problems and difficulties. The nation needs a robust organic policy creation.

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REFERENCES

1. FAO Publications Catalogue 2022, *Food and Agriculture Organization of the United Nations*, Rome, Italy, Oct. 2022, 136 p. doi: 10.4060/CC2323EN.
2. Kumar, Vineet. CSE report flags poor state of

- organic fertilisers, biofertilisers sector in India, India, 2022. <https://www.downtoearth.org.in/blog/agriculture/cse-report-flags-poor-state-of-organic-fertilisers-biofertilisers-sector-in-india-82647> (Accessed Feb. 28, 2023).
3. A. K. Barik & Sarkar, N.C. Organic Farming in India: Present Status, Challenges and Technological Break Through. *In Proceedings of Third International Conference on Bio-resources and Stress Management*, 2017, 84-93.
 4. Babu, C. & Karunakaran, N. Status, benefits and future prospects of Organic Farming in India: A review. *J. of Management Res. and Anal.*, 2021, **8**(3), 103–111. doi: 10.18231/J.JMRA.2021.022.
 5. Chadha, D. & Srivastava, S. K. Growth Performance of Organic Agriculture in India. *Current J. of Appl. Sc. and Tech.*, 2020, **39**(33), 86–94. doi: 10.9734/CJAST/2020/V39I3331022.
 6. Agriculturepost.com. 5 Govt schemes, promoting Organic Farming in India . India, 2023, <https://agriculturepost.com/farm-inputs/5-govt-schemes-promoting-organic-farming-in-india/> (Accessed Feb. 28, 2023).
 7. Department of Agriculture & Horticulture, Government of Assam, India . Mission Organic Value Chain Development in Assam (MOVCD). <https://agri-horti.assam.gov.in/schemes/mission-organic-value-chain-development-in-assam-movcd> (Accessed Feb. 28, 2023).
 8. Meena, S.S. & Bhusanar, S.B. Organic Farming in India Present Status and Challenges. *In Handbook of Emerging Trends in Agribusiness and General Management*, edited by Satyaveer Singh Meena, Vikash and Hanuman Prasad, Himanshu Publication Delhi and Udaipur, 2022, 207p. https://www.researchgate.net/publication/364322060_Organic_Farming_in_India_Present_Status_and_Challenges (Accessed Feb. 28, 2023).
 9. Manifest Learning Academy. Status of Organic Farming in India – Journals of India. <https://journalsofindia.com/status-of-organic-farming-in-india/> (Accessed Feb. 28, 2023).
 10. Roychowdhury, R. ; Banerjee, U. ; Sofkova, S. ; & Tah, J. Organic Farming for crop improvement and sustainable agriculture in the era of climate change. *Online J. of Biological Scs.*, 2013, **13**(2), 50–65, doi: 10.3844/OJBSCI.2013.50.65.
 11. Lockeretz, W. ; Freedgood, J. ; & Coon, K. Farmers' views of the prospects for agriculture in a metropolitan area. *Agricultural Systems*, 1987, **23**(1), 43–61. doi: 10.1016/0308-521X(87)90072-2.
 12. Letourneau, D. K & Goldstein, B. Pest damage and arthropod community structure in organic vs. conventional tomato production in California. *J. of Applied Ecology*, 2001, **38**(3), 557–570, Jun. 2001, doi: 10.1046/J.1365-2664.2001.00611.X.
 13. Mäder, P. ; Fließbach, A. ; Dubois, D.; Gunst, I. ; Fried, P. ; & Niggli, U. Soil fertility and biodiversity in Organic Farming. *Science*, 2002, **296**(5573),1694–1697. doi: 10.1126/SCIENCE.1071148.
 14. Darnhofer, I. Strategies of family farms to strengthen their resilience. *Environmental Policy and Governance*, 2010, **20**(4), 212–222. doi: 10.1002/EET.547.
 15. Debnath, R.M. Opportunities and challenges of organic agri-food organisations: a case study from india. *Indian Journal of Public Administration*, 2021, **67**(4), 608–619. doi: 10.1177/00195561211042978.
 16. Brar, B.S., Singh, J., Singh, G. and Gurpreet-Kaur. 2015. Effects of long-term application of inorganic and organic fertilizers on soil organic carbon and physical properties in maize–wheat rotation. *Agronomy*, 2015, **5**, 220- 238. doi: 10.1377/001355656211072978.
 17. M. M and G. M. K., “New Agriculture Technology in Modern Farming,” *International Journal of Management Research and Social Science*, **8**(3), doi: 10.30726/IJMRS/V8.I3.2021.83016.
 18. Garg A., “Recent Trends in Agriculture: Vertical Farming and Organic Farming,” *Advances in Plants & Agriculture Research*, 2014, **1**(4), doi: 10.15406/APAR.2014.01.00023.
 19. Satish S. Tambe, “Our Heritage Recent Trends In Organic Farming In India: A Review Article.” https://www.researchgate.net/publication/350134533_ (Accessed on Mar. 01, 2023).
 20. Singh P., “Management of the Pandemic: Agriculture, Food Management and Resilience During Covid-19 in India,” *Indian Journal of Public Administration*, 2019, **67**(3), 324–336, doi: 10.1177/00195561211045094.
 21. Yadav C. and Pandey S., “Status of the use of Organic Fertilizers in India: A Review,” *Agricultural Reviews*, 2020, **7**, doi: 10.18805/AG.R-1961.
 22. Aryal J.P., Sapkota T.B., Krupnik T. J., Rahut D. B., Jat M. L., and Stirling C. M., “Factors affecting farmers’ use of organic and inorganic fertilizers in South Asia,” *Environmental Science and Pollution Research*, 2021, **28**(37), 51480–51496, doi: 10.1007/S11356-021-13975-7/TABLES/10.
 23. Sharma A.K., “ALN No. 58: Sharma: The potential for Organic Farming in the drylands of India **58**, Winter 2005 Soil management for drylands the potential for Organic Farming in the drylands of India”, <http://cals.arizona.edu/OALS/ALN/aln58/sharma.html> (Accessed Feb. 28, 2023)
 24. Mahadeo S Deshmukh, Nitin A Babar, “Present Status and Prospects of Organic Farming in India.”, *Journal of Management Research and Analysis* https://www.researchgate.net/publication/282243181_Present_Status_and_Prospects_of_Organic_Farming_in_India (Accessed on Mar. 01, 2023).
 25. Imran, Amanullah, Hussain I., “Agricultural soil reclamation and restoration of soil organic matter and nutrients via application of organic, inorganic and bio fertilization (Mini review),” *IOP Conference Series: Earth and Environmental Science*, **788**(1) , 012165, doi: 10.1088/1755-1315/788/1/012165.
 26. Aryal J.P., Sapkota T., Rahut D.B., and Jat M.L.,

- “Agricultural sustainability under emerging climatic variability: the role of climate-smart agriculture and relevant policies in India,” *International Journal of Innovation and Sustainable Development*, **14**(2), 219–245, 2020, doi: 10.1504/ijisd.2020.106243.
27. C. Liu, H. Cutforth, Q. Chai, and Y. Gan, “Farming tactics to reduce the carbon footprint of crop cultivation in semiarid areas. A review,” *Agronomy for Sustainable Development*, **36**(4), doi: 10.1007/s13593-016-0404-8.
 28. “MOVCD-NER.” <https://movcd.dac.gov.in/> (Accessed on Feb. 28, 2023).
 29. “Paramparagat Krishi Vikas Yojana (PKVY) Manual for District-Level Functionaries 2017”. (Accessed Feb. 28, 2023)
 30. “Mission Organic Value Chain Development for North Eastern Regions (MOVCDNER) INM Division, Ministry of Agriculture and Farmers’ Welfare Mission Organic Value Chain Development for North Eastern Region a Sub-Mission under National Mission for Sustainable Agriculture (NMSA) Operational Guidelines,” 2018.
 31. “Official Website of One District One Product Uttar Pradesh” <https://odopup.in/en/page/district-wise-products> (Accessed on Feb. 28, 2023).
 32. “National Policy for Farmers 2007 by Department of Agriculture and Farmers Welfare| National Portal of India.” <https://www.india.gov.in/national-policy-farmers-2007-department-agriculture-and-cooperation> (accessed Feb. 28, 2023).
 33. “5 Govt schemes, promoting Organic Farming in India - Agriculture Post.” <https://agriculturepost.com/farm-inputs/5-govt-schemes-promoting-organic-farming-in-india/> (Accessed on Feb. 28, 2023).
 34. “Sikkim: India’s First Organic State; RTSV - In Depth programme analysis.” <https://byjus.com/free-ias-prep/sikkim-indias-first-organic-state-rstv-in-depth/> (Accessed on Feb. 28, 2023).
 35. “Organic Farming in Karnataka, How to Start | Agri Farming.” <https://www.agrifarming.in/organic-farming-in-karnataka-how-to-start> (accessed Feb. 28, 2023).
 36. “Sri Lanka’s Organic Farming Experiment Went Catastrophically Wrong.” <https://foreignpolicy.com/2022/03/05/sri-lanka-organic-farming-crisis/> (Accessed on Feb. 28, 2023).
 37. Narayanan D.S., “Organic Farming in India: relevance, problems and constraints,” *Sustainable Agriculture*, **5**(4), 2005.
 38. “Why China is emerging as a leader in sustainable and organic agriculture.” <https://theconversation.com/why-china-is-emerging-as-a-leader-in-sustainable-and-organic-agriculture-132407> (accessed Feb. 28, 2023).
 39. Scott S., Si Z., Schumilas T., and Chen A., “Organic food and farming in china: Top-down and bottom-up ecological initiatives,” *Organic Food and Farming in China: Top-down and Bottom-up Ecological Initiatives*, pp. 1–218, 2018, doi: 10.4324/9780203701706.
 40. S. M and Basavaraju S.M., “Growth and present status of Organic Farming in india and global level,” *Paripex Indian Journal of Research*, pp. 56–57, 2022, doi: 10.36106/PARIPEX/0807327.
 41. Singh R.K., Singha M., Singh S. K., Pal D., Tripathi N., and Singh R. S. , “Land use/land cover change detection analysis using remote sensing and gis of dhanbad district, india,” *Eurasian Journal of Forest Science*, 2018, doi: 10.31195/EJEJFS.428381.
 42. Doran J.W. and Zeiss M., “Soil health and sustainability: Managing the biotic component of soil quality,” *Applied Soil Ecology*, **15**(1), 3–11, doi: 10.1016/S0929-1393(00)00067-6.
 43. Urra J., Alkorta I., and Garbisu C., “Potential Benefits and Risks for Soil Health Derived from the Use of Organic Amendments in Agriculture,” *Agronomy* **2019**, **9**(9), 542, doi: 10.3390/AGRONOMY9090542.
 44. “Reclamation of Problem Soils (RPS)-A Sub Scheme of RKVY Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture, Cooperation & Farmers Welfare (Natural Resource Management Division)”. <https://pib.gov.in/PressReleseDetail.aspx?PRID=1741966> (Accessed Feb. 28, 2023)
 45. McArthur J.W. and McCord G.C., “Fertilizing growth: Agricultural inputs and their effects in economic development,” *Journal of Development Economics*, 2017, **127**, 133–152, doi: 10.1016/j.jdeveco.2017.02.007.
 46. Kalpana P., SaiBramari G., and Anitha L., “Formulation of potential vegetable waste compost in association with microorganisms and *Spirulina platensis*,” *Asian Journal of Plant Science & Research*, 2011, **1**(1), doi: 10.1107/s14573-026-0404-6.

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