***Review Article***

**Issues and Opportunities for Organic Agriculture in West Bengal and India**

**Abstract:**

In West Bengal and throughout India, organic farming has a long history; nevertheless, crop production using contemporary organic management techniques is still in its infancy. The primary barriers to the widespread adoption and conversion of current crop production practices to an organic farming system are low premium prices, high conversion costs, a high rate of illiteracy, subsistence farming, fragmented holdings, the current land tenure system, farmers' and consumers' lack of awareness, lower yield during and after conversion, a lack of dedicated organic marketing channels and markets, and a costly and intricate organic certification system.

The varied agroclimatic conditions that support the growth of numerous high-value crops, such as medicinal plants and herbs, as well as the nearly traditionally farmed long tracts of hilly regions, tribal-dominated areas of southern red laterite zones, and coastal and saline regions, offer an opportunity for organic conversion with ease and little effort.

Both the government and non-governmental organizations can play an important role in developing policies that promote and develop organic farming, building marketing facilities, introducing an affordable organic certification system that is farmer-friendly, and offering sufficient incentive packages to encourage producers.

The local and global markets' rapidly increasing desire for organic food has created a new avenue for agricultural growth, and the state and the nation can become global leaders in the manufacturing and distribution of organic products in the future if these issues are properly addressed.

Keywords: Organic Certification, Organic Farming, Marketing, Agriculture, Policy, Prospects

Highlight:

With an emphasis on West Bengal's potential for growth through improved rules, certification, and market expansion, the paper outlines the challenges facing organic farming in India.

**Introduction :**

Organic farming has been practiced in India for 10,000 years. During that time, farmers grew crops using only natural resources. Ancient texts like the Rigveda, Ramayana, and Mahabharata provide ample evidence for it (Bhattacharya and Chakraborty, 2005; Dagar and Tewari, 2017). When plant nutrients were applied using materials derived from plant and animal sources, the great Indian civilization was actually expected to flourish in organic farming. Nevertheless, not much had been done to recognize traditional Indian farming practices as being better than conventional crop cultivation systems until 1905, when Sir Albert Howard, a British botanist and the father of modern organic farming, was appointed as the former Director of the Institute of Plant Industry Indore and Agricultural Adviser to States in Central India and Rajputana, the then-Bengali. His research into enhancing organic farming was later chronicled in his well-known book "An Agricultural Testament," published in 1940. The organic farming idea, which uses compost primarily for crop production while also improving soil quality, is the result of his years of agricultural research and observation. However, it is now known that food production growth has not kept up with India's population growth rate in the latter period. Due to extreme food shortages in the 1950s and 1960s, the government was compelled to import food grains from other nations. The Food problem became so grave that the government apprehended the death of millions of poor Indians due to hunger in the mid of 1970s. After several years of tireless effort and experiments under the aegis of M.S. Swaminathan, India has achieved success in generating a new crop production system popularly known as Green Revolution technology and the country not only avoided epidemic but also became self-sufficient in food grains production within a few years (Roy Chowdhury et al., 2013, Mondal, S. and Palit, D.,2021). The "Green Revolution" produced technology that combined high-yielding cereal varieties—mostly wheat—with increased dosages of chemical fertilizers, pesticides, and irrigation. This technology gradually spread throughout the nation. In order to meet the increasing need for food production brought on by a faster rate of population development, fertilizers and insecticides have been used more often over time (Charyulu and Biswas, 2010, Hemathilake and Gunathilake, 2022). During this period, the policymakers did not find it necessary to pay heed to the ill effects of this modern technology on the environment and human health. However, the grim situation in the agril sector came to the surface in the last decade of the twentieth century when the productivity growth rate of major food grains started to show a declining trend, though not stagnant. Reduced soil fertility (Sehgal and Abrol 1994; Sharma, A., Kumar, V., Shahzad, B. *et al* 2019), and growing resistant capacity of some major parts toward pesticides associated with over lifting of underground water were identified as major causes of this apologetic state of affairs in the agricultural sector. Again, indiscriminate use of fertilizers produced from products of fossil-fuel, and plant protection chemicals (Khan *et al.* 2010; Ononogbo, C., Ohwofadjeke, P.O., Chukwu, M.M. *et al.* 2024; Shukla., A.K.,*et al.*2022), it is believed that micronutrients cause health risks, environmental contamination, and natural deprivation. Overlifting of underground water has resulted in a drinking water crisis in many parts of the country and also caused deadly diseases arising out of arsenic, contamination. The concern of scientists and environmentalists in regard to the effects of modern farm technology has been reflected in past studies made by them. Traditional methods lead to (a) the depletion of non-renewable energy resources for the production of fertilizers, pesticides, and powering mechanized equipment; (b) health, air, and water hazards; and (c) a decline in soil quality. For example, in certain regions, growers used excessive amounts of synthetic fertilizers to achieve high yields, but this contaminated groundwater (Canter, 1996; Singh. B andCraswell. E, 2021; Sartain, 1990; Srivastav, A.L., et al. 2024; Snyder et al., 1984; Randive, K., et al.2021). Increased tillage without the addition of organic manures increases soil erosion in areas where soil surfaces are left bare and decrease soil organic carbon (Ayers, 1936; Hati, K.M., *et al.* 2020; Sharma, S., *et al.* 2022).

Proponents for organic agriculture have vehemently rejected the allegation out-right and reiterated that small farmers all over the world will harvest the benefits from this type of alternative agricultural system with low capital requirements, the ability to use traditional knowledge, and high premium pricing of 20–30% over conventional farming (Gumber and Rana, 2017; Durham, T.C. and Mizik, T. 2021; Bisht, I. S.,2020). According to the International Fund for Agriculture Development (IFAD), organic farming can significantly benefit small farmers in China, India, and Latin America and will contribute to reducing poverty in these nations (Chandrashekar, H.M. 2010; [Azam, M.S.](https://www.emerald.com/insight/search?q=Md%20Sikandar%20Azam) and [Shaheen, M.](https://www.emerald.com/insight/search?q=Musarrat%20Shaheen),2019). However specialists apprehend that premium prices received by future growth in supply and new customers will probably result in a decline in organic producers may not be willing to pay higher prices and small farmers will be in trouble. Small farmers may also find themselves in different situations regarding the marketing of products. Generally, farmers' associations establish direct contact with buyers and help small farmers in getting higher prices. Long-term contracts have been better choice for a safe market and more stable prices. Production and marketing through contract farming may protect small farmers from down fall of income. Due to their ease of use and often lower quality requirements, organic products are expected to be a desirable alternative for small farmers in emerging economies like India, where the domestic market for them exhibits development potential (Scialabba, N. 2000; Selvan T., *et al*. 2023).

An important concern for farmers in nations with low incomes is the conversion period, which determines whether an item or section of land can be considered organic. This period of time provides a possibility to begin applying organic management practices, increase soil fertility and biological activity, and create a sustainable and viable agroecosystem. It takes three years for a switch from a conventional to an organic agricultural method before produce can receive a certification as organic (USDA, 1980). During the transformation period, farmers face suppression in yield temporary resulting in a reduction in income that effects farmers adversely and may also act as a deterrent in farmers' acceptance of organic farming, particularly small-scale and marginal farmers in emerging nations like India. Growers encounter a period of lowered yields while switching to an organic production system, which is followed by a recovery to yields that are comparable to or higher than those obtained with conventional agriculture (Clarke *et al.,* 1998, Patel, S.K.,*et al.* 2020).

In order to promote sustainable agricultural development, organic farming has become a competitive alternative to the current crop production systems, which include conventional and inorganic farming. It is now perceived to be the panacea of all evils arising out of agricultural chemical-based modern crop cultivation method popularly known as ‘Green revolution’ technology in India. The debate about whether organic farming has the capacity to surmount the challenges faced by present-day agriculture worldwide as claimed by the proponents of organic agriculture is going on some of which are discussed in the previous chapter in the form of myths and realities. However, the reality is that the demand for organic products is rapidly increasing both domestically and internationally (Bhattacharya and Chakraborty, 2005; Basha, M.B and Lal, D. 2019).

Countries have shown interest in promoting organic farming worldwide, including India, as a means of capitalizing on emerging prospects in the agricultural industry. To expedite India's organic movement, the Indian government, along with West Bengal and other state governments, has implemented special initiatives and established agencies and organizations to develop policies, establish organic standards, certify marketing facilities, and other related tasks.

However, it is highly challenging to introduce and widely embrace an organic farming system in a nation with more than 1.2 billion people. It requires an in-depth knowledge of the challenges and opportunities generated by transformation in the agriculture industry. Problems concerning the growing popularity of organic farming in West Bengal and across India will be the main topic of this section.

**Problems**

The following are the major problems that may impede the progress of organic movements in the state, West Bengal in particular, and the country as a whole.

**A. Problem-related to organic conversion:**

The conversion refers to shift in farming systems from conventional to organic management practices involving a number of innovations and changes in the farm systems as well as production methods (Lampkin, 1994; Bouttes, M.*et al.*,2019). The conversion period is the period needed for the physical and biological characteristics of the soil to change in order to improve plant growth, nutrient recycling, and the system's ability to control pests biologically. Generally, it takes two to three years to make the soil completely chemical-free and augment microbial activities necessary for supplying plant nutrients. But before conversion, farmers need to be convinced and motivated as regards to the advantages of organic farming. The following are associated problems here:

**a) Lack of awareness**

In essence, organic farming requires more expertise than it does chemicals and money. So, farmers must have adequate knowledge to understand the harmful effects of fossil fuel-based chemicals induced by conventional as well as purely inorganic systems and beneficial aspects of organic farming from the viewpoints of soil fertility, bio-diversity, human health and nutrition, economic benefits etc. But in a country like India where about one-third of total population is illiterate, it is difficult to persuade people to undertake organic farming in place of a conventional system. According to Jangid et al. (2012) ignorance on the application of biofertilizers, including its concentration, timing, and technique. Learning of the organic package of crop production technique may pose a threat to the adoption of the system.

**b) Problems of small farmers**

Both nationally and in the state specifically, the agricultural sector is dominated by marginal and small farmers. They view agriculture not as a business but as a way of life. As they operate at the subsistence level, the consumption requirement of the farm family is the top priority. They are apprehensive as to whether low yield of organically produced crops will ensure family food security.

There are many challenges for small farmers who want to grow organic food. The starting low price of organic products, the absence of specialized markets, early yield loss, and high transportation expenses were only a few of the economic and marketing obstacles they had to overcome (Haneef *et al.,* 2019).

**c) Problems of tenants**

The majority of small and marginal farmers are tenants, and it appears that their fragile land-tenancy arrangement prevents them from embracing organic farming. The reason is the high initial investment required for shifting to organic production and the return will come in some future time. So, farmers may not be willing to convert as they are not sure how long they will stay on that land and the landowners may not permit conversion fearing difficulties in evicting tenants in the future. Carolan *et al.* (2004) determined that landowners and renters must work together to reduce tenant uncertainty, which is a hindrance to sustainable agriculture, and to ensure ongoing investment.

**d) Problems of fragmented holding**

Fragmented holding is another important hurdle to be overcome in the large-scale adoption of market-oriented organic programme in West Bengal.

The high input-intensive agriculture may be beyond the means of small and scattered marginal farmholders. The low-cost/high-profit margin packages are necessary for this particular group of farmers. Integration of several operations and organic farming methods requires careful attention in light of the present problems facing agriculture, especially small-scale farmers (Ravisankar, 2017).

**e) Social Problems**

Social structure can influence the decision-making on shifting of farming system. The degree of training, the desire to take on the dangers of conversion, and family conflicts (such as those between generations on the farm's future course) all significantly impact the conversion's effectiveness. The results of Sanghi (2007) indicate that organic farming has a limited coverage reach and social impact. Conversion may also be hampered by other communities' lack of cooperation; for example, nearby conventional or inorganic farms may pollute organic crops.

**f) High input cost**

Higher cost on labor and bio-fertilizers, sometimes act as a deterrent in large-scale conversion. Higher input of human laborers is required for carrying out manual weed control compost preparation, harvesting, processing etc. that are necessary to meet the standards of organic products. Inadequate availability of compost and bio-fertilizers may also raise the cost of cultivation of organic products.

Additional expenses of packaging, and warehouses. and processing (Gibbon and Bolwig, 2007), the usage of transplants (Clark et al., 1999; Brumfield et al., 2000), and labor costs for manual weeding and harvesting may additionally increase input prices.

**g) Low yield**

Crop yield is exceptionally low when converting from a conventional to an organic system, especially in the initial years of conversion. Growers encounter a time of decreased yields when switching to an organic production system, followed by a return of yields that are comparable to or near conventional production levels (Clark et al., 1998, Peter, 1991). This can be largely attributed to the withdrawal of the supply of chemical-based plant nutrients and the deficit is the supply of nutrients from organic sources. So, marginal and small farmers may find it difficult to face the situation and be reluctant to convert.

**h) Low income**

Relatively lower income of organically grown crops particularly, growers during the transition period may hinder undertaking conversion (Sellen *et al*, 1996, David W. Crowder et al. 2015). Shifting of the farming system is associated with a reduction in yield compared to conventional, even yield obtained in subsequent periods of conversion. Again, farmers do not get the adequate premium prices required to make organic farming economically viable for goods produced during 2-3 years of the conversion period. So, drastically reduced yield coupled with low premium price result in lower income for farm families. In some countries, products are sold with the level of ‘in-conversion product’ and fetch small premium prices, but not sufficient to fully compensate the loss in income.

Besides, lack of information, difficulties in getting access to information, lack of technical knowledge, price risk, etc. are also represent impediments to undergoing organic conversion. Conventional farmers’ perception and access to technical and financial information have been identified as significant barriers to conversion (Fisher, 1989, Henning *et al.,* 1994, Chadwick and McGregor, 1991, Vogtman *et al.,* 1993). There are some other practical difficulties in the way of adoption of organic/biological resources for nutrition (sufficient in case of tea plantation as plenty availability of bio-resources compared to other crops) and plant protection procedural complexities, detailed accounts of farm activities, unaffordable cost of certification, etc. (Sharma, G. *et al.,* 2008).

**B. Problems of organic certification (The new sub heading?)**

The process of verifying the products are produced in accordance with specific standards for organic production and can be considered organic is known as organic certification. It is a guarantee that the products and its raw ingredients have been produced according to certain standards set for farmers, and food manufacturers. Producing organic foods and other agricultural items is a complicated procedure (C S Aulakh et al, 2017). In general, any business directly involved in food production can be certified including seed providers, farmers, food producers, merchants and restaurants etc. It is usually signified by a symbol or label and usually accompanied by the word ‘certified organic’ items or word to that effect. Products must be manufactured and grown in strict accordance with the standards stipulated by the nation in which they are sold in order to receive certification. Third-party or participatory certification processes can be applied to organic certification. In addition to their usual duties, farmers must also perform new activities for third-party certification. These include studying criteria for products, farm facilities, and production methods (compliance); documenting farm history; current organic setup; soil fertility; creating a written production plan that includes the source of seeds; field conditions; crop locations; fertilization; pest control; harvesting techniques; storage locations; inspecting the farm for physical verification; paying the annual certification fee; and keeping monitor of daily farming operations and marketing records. High cost and challenges for certification and inspection (Mahata, G. 2021). Participatory certification is a locally focused quality assurance system that guarantees products based on active stakeholder participation and is based on social networks, trust, and knowledge expressing (IFOAM, 2008). For customers, it provides product assurance and increases confidence through recognizing suppliers of goods for use in certified activities. APEDA oversees the certification of organic products in India in accordance with national organic production regulations. USDA and the European Commission have approved the production criteria and accreditation system developed by the National Program for Organic Products (NPOP).

The whole exercise is complicated and hazardous that may discourage willing farmers to go for organic conversion particularly, the marginal and small farmers of India as well as West Bengal. Again, organic certification normally is not permitted in the name of producers themselves, nor they have any control over it. It is released under the identities of non-governmental organizations (NGOs) or marketing agencies. The cost of organic certification is also too high (SESHIA GALVIN, S. 2018) for small farmers as they have to bear the cost of inspection, record keeping, and maintaining quality standards. This technical process creates a paternalist situation which is detrimental to small farmers. As they remain outside the total learning process of certification, they may feel like outsiders in spite of being the owner of the product. Their enthusiasm and dedication to organics may suffer as a result of their lack of participation. In that case, they lose options of selling products to other buyers and hence, are deprived of bargaining power resulting in lower premium prices for their products.

On the other hand, organic consumers may not get true organic products in spite of paying high premiums as once certified, non-compliance of organic standards basically constitutes fraud. Such frauds harm the interest of both producers and consumers resulting slow growth in the organic movement. Organics essentially depends on trust, and even one or two product standards violations could be enough to have clientele stop buying from you.

**(i) Problems of Marketing (This belongs to which sub heading? Or the C sub heading?)**

An effective advertising plan is essential to a nation's agricultural development, and this is especially accurate for market-oriented organic products. In fact, the lack of an efficient marketing system, particularly, marketing channels deprives organic producers of getting high premium prices. The absence of definite marketing channels is the reason of selling directly to consumers at low premiums (Ondrasek, G. 2023). Sometimes, agents of a company or NGO act as middlemen and perform various marketing activities such as grading, packaging, processing etc. and retain a larger part of organic prices paid by consumers. Lack of proper technical guidance or production technology, which they might have acquired through direct contact with exporting companies, is the most challenging challenge for small farmers to overcome. They would have benefited from easy access to market information technology in the form of higher premium prices. Again, a significant amount of market-oriented organic farming, farmers and trade corporations have a contract whereby the companies predominate and the farmers have minimal impact. Younisi, H., *et al.* (2017) stated that the main obstacles facing consumers and marketers are excessive prices, non-availability, ignorance, and expensive logistics costs. But it is imperative that we overcome market obstacles and seize new opportunities. Organic farmers sell products as raw materials directly to consumers or intermediaries. Supermarkets located in large towns mostly deliver processed products. In short, marketing channels for organic products in the domestic market is limited and the primary orientation is towards export or large towns and cities through supermarkets. Producers can exploit local benefits at low premium prices if production costs are lower, improved soil, and self-reliance inputs coupled with favorable agro-climatic conditions. There isn't a distinct demand for organic goods in the domestic market, and if there is, it doesn't provide any incentives for organic manufacturing. However, in recent years, several organizations have been working to establish distinct markets for organic goods. However, there are other barriers to international organic product marketing, including price expectations, delivery delays, quality limitations, lack of certification, and market networks.

**J) Lack of Finance (This belongs to which sub heading?)**

It is rarely detrimental to yield or output to move from traditional or rustic cultivation to organic, therefore direct financial assistance is not required to bridge the conversion gap (IFDA, 2005). Resource-poor small farmers need credit for making investments, particularly during the conversion phase. As they have limited access to institutional sources of credit, a shortage of fund sometimes act as constraints in the adoption of the organic system. Again, cost of certification put an additional financial burden on small landholders. Not only production credit, but also, they frequently need consumption loan because the lag period starting from conversion to return obtained from marketing is too long. But small farmers do not get any financial support, especially for organic production whereas farmers practicing conventional farming systems generally get.

Besides these, inadequate availability of enriched bio-manures, bio-fertilizers, consciousness of consumers, lack of legal enforcement for fake organic producers, absence of training facilities for improvement of quality standards and certification processes, etc. further impede the organic movement's advancement in West Bengal and throughout India.

**Prospects of organic farming in West Bengal and India**

The issues highlighted are undoubtedly impeding the growth of organic farming in West Bengal and throughout India. Nevertheless, organic farming can be successfully introduced if organic infrastructure is available, adequate education is provided to raise awareness among producers and consumers, organic crop management practices are guaranteed, a system of financial support is developed, farming growers-friendly certification procedures are in place, and marketing facilities are available. The state is endowed with varied agro-climate conditions suitable for growing large varieties of crops starting from cereals, pulses, and fibers to high-valued fruits and vegetables crop species including medicinal plants which have large demand in the international market. Organic farming is incredibly comparable to the state's illustrious heritage of conventional farming. The state has long tracts of hilly areas and adjoining parts, tribal-dominated rainfed regions in the south that can easily be brought under organic agriculture. Traditional farming is more or less practiced in the hilly, rainfed, tribally dominated northeastern regions of India (Veeresh, 1999). The prospects of organic farming have improved due to the growing demand for organic products globally as well as domestically, and the state may readily capitalize on the advantages of organic farming adoption. Organic farming can be used as a risk management strategy that minimizes input costs, enhances income, and improves food security for marginal and small farmers.

For the landless population, who are regarded as the most vulnerable of the poor, the initial high level of labor required, especially during the transition phase, will generate more job prospects. So, the introduction of organic farming will check the emigration of labors to urban areas and hence will contribute to rural stability. Because they can readily turn farm waste into organic compost when domestic animals are added to the system and make bio-pesticides from locally accessible plant extracts like neem (*Azadirachtum India*) and karamcha (*Pongamia glabra*), small farmers do not confront a shortage of inputs. The advantages of a localized organics strategy include the creation of new non-farm business opportunities through the local manufacture of these biopesticides. Preparing and selling compost and other inputs to other farmers, such as vermicompost, bio-dynamics preparations, natural insecticides, etc., can also help farmers make extra money. Higher grain yields and reduced cultivation expenses are the reasons for the improved net returns in green manuring treatments. Green manure also produced a higher return, according to Ali, M. (1999).

Such local enterprises built up using traditional indigenous knowledge can enrich product quality by collecting feedback from their clients. These small enterprises will not only increase the availability of organic inputs to interested farmers heading to convert farming practices, but also provide self-employment scope for unemployed rural youths. In order to satisfy the rising demand for organic manufactured goods (both input and output) in the domestic and international markets, it is anticipated that organic industries will thrive in the years to come. This will result in the creation of more job opportunities and foreign exchange revenues. Again, the national standards for the promotion and development of organic products formulated by National Programmes for Organic Production (NPOP) along with conformity assessment procedures for accreditation are recognized and considered as equivalent to that of U.S.A., European Unions, and Switzerland standards. This accreditation makes it possible for organic products that have been properly certified by India's recognized certifying bodies to enter foreign markets. So, this form of alternative agriculture will help many sick industries to turn around as happened in case of the world-famous ‘Darjeeling Tea’ of West Bengal. During the past few years, tea industry of West Bengal is gradually sliding mainly due of a decrease in yield and deterioration of quality resulting deceleration in demand in the international market. This lack of demand is attributable to high content of pesticide residue in tea resulting cancellation of export consignments in recent past. This has prompted many garden owners to shift to organic tea cultivation from existing farming practices. They are now able to make profit by exporting tea to Western countries including USA and Germany. This transition of conventional tea gardens to organic has given a new life to the morbid tea industry of West Bengal. Through product diversification, such as the manufacturing of herbal and green teas, among many other items with strong domestic and worldwide demand, there is also plenty of room for market expansion. Similarly, the production of internationally famous Darjeeling orange, fruits and vegetables, exotic plant species including orchids, anthurium, cactus, medicinal plants etc. by organic means will help the state to earn huge foreign exchange through export to other countries and at the same time, will uplift the standard of living of growers of this underdeveloped region. Other districts in the state may potentially see initiatives to develop and promote organic farming. With a view to exploit the unexplored aspects of commercial agriculture, Govt. of West Bengal has resolved to set up bio-villages in each of the 341 blocks in the next two years to create role models for the adoption of organic farming in large scale.

Recently, the Government has taken programs to make farmers aware through organizing a series of workshops, training, and demonstrations and motivating farmers to produce and use bio inputs, and bio-pesticides and also making all efforts to create separate marketing outlets to help organic growers getting right prices for such products. So, it is expected that the continuous efforts of the Government of West Bengal in collaboration with Non-Governmental Organisations (NGO’s) to execute these programs will help to achieve desired results in the long run.

**Suggestions**

To achieve success and sufficient progress in the organic movement and also to use it as an important instrument for poverty alleviation, ensuring food security for all and obviously to safeguard environmental problems including human health, both the State and Central Government along with NGO’s in collaboration with International Fund of Agricultural Development (IFAD) have to play a pivotal role. In a state like West Bengal where a sizable portion of total population are illiterate and agriculture is characterized as dominated by marginal and small farmers, it is very difficult to convince them to shift towards organic farming from traditional cultivation methods. As organic growing requires more understanding than chemical and financial farming, a long time needs to be invested to make farmers aware of the demerits of conventional systems and the advantages of modern organic crop production management practices including crop planning. The primary driver behind farmers' adoption of the organic approach is the higher premium prices that result in increased income, particularly the marginal and small farmers, details of financial benefits to be realized in the short term as well as in the long run need to be assured. This requires continuous training, workshops, and demonstration programmers by experts or professionals. It is more effective to choose prominent farmers who are interested in organic farming, both personally and professionally, than to attempt to convert the entire agricultural sector at once. The presence of a solid institutional support system that can initially make it easier for farmers to obtain the numerous essential components they endure with, such as technology, initial funding, certification, input production, marketing, etc., is arguably the most crucial element for successful adoption. Developing farmer-level capacity (local farmers groups, local training, and advisory services) should be a key component of any strategy that utilizes organic farming as a means to mitigate poverty (IFAD, 2005).

The concerned government must offer financial assistance in the form of subsidies to interested farmers, particularly small farmers who lack access to institutional credit, during the early stages of conversion when yields are low. This assistance must include provisions for advancing consumption credit. Contract farming could be a starting point for simple access to organic marketing systems, certification, and information.

Business firms need to extend support to expedite the movement by ensuring the supply of essential organic inputs, product diversification, and creation of marketing and export facilities that will ensure higher premium prices for products. In summary, organic farming has the potential to be a significant tool for reducing poverty and ensuring food security in West Bengal and India in the long run, if the government and non-governmental organizations (NGOs) actively support it. This includes everything from raising consumer and grower awareness to ensuring that the product is disposed of in the domestic or international market.

**COMPETING INTERESTS DISCLAIMER**:

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

**References:**

1. Ali, M., 1999. Evaluation of green manure technology in tropical lowland rice systems. *Field Crops Research*. 61(1): 61-78.

Aulakh, C.S. and Ravisankar, N. 2017. Organic Farming in Indian Context: a Perspective. *Agric Res J*. 54 (2) : 149-164.

1. Ayers, Q.C. 1936. Soil erosion and its control. [London and New York: McGraw-Hill Publishing Company, Ltd.](https://www.cabidigitallibrary.org/action/doSearch?AllField=pb%3A%28%22London+and+New+York%3A+McGraw-Hill+Publishing+Company%2C+Ltd.%22%29).

1. [Azam, M.S.](https://www.emerald.com/insight/search?q=Md%20Sikandar%20Azam" \o "Md Sikandar Azam) and [Shaheen, M.](https://www.emerald.com/insight/search?q=Musarrat%20Shaheen) 2019. "Decisional factors driving farmers to adopt organic farming in India: a cross-sectional study", [*International Journal of Social Economics*](https://www.emerald.com/insight/publication/issn/0306-8293), Vol. 46 No. 4: 562-580. <https://doi.org/10.1108/IJSE-05-2018-0282>
2. Basha, M.B. and Lal, D. 2019. Indian consumers' attitudes towards purchasing organically produced foods: An empirical study, Journal of Cleaner Production, Volume 215, Pages 99-111, ISSN 0959-6526, <https://doi.org/10.1016/j.jclepro.2018.12.098>.
3. Bhattacharyva, P. and Chakraborty, G. 2005. Current status of organic farming in India and other Countries, *Indian Journal of Fertilisers*. 1(9): 111–123.
4. Bisht, I. S. 2020. Agri-food system dynamics of small-holder hill farming communities of Uttarakhand in north-western India: socio-economic and policy considerations for sustainable development. *Agroecology and Sustainable Food Systems*, *45*(3), 417–449. <https://doi.org/10.1080/21683565.2020.1825585>
5. Bouttes, M., Darnhofer, I. & Martin, G. 2019. Converting to organic farming as a way to enhance adaptive capacity. *Org. Agr.* **9**, 235–247. https://doi.org/10.1007/s13165-018-0225-y
6. Brumfield R.G. et al., 2000. Comparative Cost Analyses of Conventional, Integrated Crop Management, and Organic Methods. Hort Technology 10: 661-840.
7. Canter, L.W. 1996. Nitrogen in ground water. Lewis Publication, Boca Raton, Fla
8. Carolan, M.S.; Mayerfeld, D.; Bel, M.M. 2004. Exner, R. Rented land: Barriers to sustainable agriculture. J. Soil Water Conserv. 59. 70A–75A.
9. Chadwick,L. and McGregor, M.1991. Non- organic farmers perceptions of and attitudes towards organic farming. Organic Farming Center Annual Report 1990. School of Agriculture, Edinburgh.
10. Chandrashekar, H.M. 2010. Changing scenario of organic farming in India: An overview. International NGO Journal Vol. 5 (1), pp. 034-039
11. Charyulu K and Biswas S. 2010. Organic input production and marketing in India – Efficiency, issues and policies. CMA Publication No. 239.
12. Clark, M. S. Ferris, H., Klonsky, K., Lanini, W.T., Bruggen, A. H. C-van., Zalom, F.G.1998. Agronomic, economic, and environmental comparison of pest management in conventional and alternative tomato and corn systems in northern California. Agriculture, Ecosystems and Environment. 68(1/2): 51-71.
13. Clark, S., Klonsky, K., Livingston, P. and Temple., S. 1999. Crop-yield and economic comparisons of organic, low-input, and conventional farming systems in California's Sacramento Valley. *Amer. J. Alternative Agric*. 14(3):109–121.
14. Dagar, J.C., Tewari, V.P. 2017. Evolution of Agroforestry as a Modern Science. In: Dagar, J., Tewari, V. (eds) Agroforestry. Springer, Singapore. <https://doi.org/10.1007/978-981-10-7650-3_2>

David W.,Crowderand, J., Reganold. P. 2015. Financial competitiveness of organic agriculture on a global scale. PNAS, Vol 112 (24), 7611 – 7616 <https://www.pnas.org/doi/epdf/10.1073/pnas.1423674112>

Durham, T.C. and Mizik, T. 2021. Comparative Economics of Conventional, Organic, and Alternative Agricultural Production Systems. *Economies*, *9*, 64. <https://doi.org/10.3390/economies9020064>

1. Fisher, B. 1989. Barriers to the adoption of organic farming in Canterbury. M.Sc. thesis Center for Research Management, Lincoln University, Lincoln, New Zealand.
2. Gibbon P. and Bolwig S., 2007. The economics of certified organic farming in tropical Africa: A preliminary assessment. DIIS Working Paper 2007:3, January 2007.
3. GOI. 2001. Reported of the working group on Organic and Bio- Dynamic Farming for the 10th Five Year Plane, Planning Commission, GOI, New Delhi, September. 1- 25.
4. Gumber, G. and Rana, J. 2017. Factors Influencing Willingness to Pay Price Premium for Organic Food in India. *International Journal of Emerging Research in Management &Technology.* 6 (2) :1-15
5. Haneef, R., Sharma, G. and Ahmad, T. 2019. Constraints Faced by Farmers Practicing Organic Farming in Hill Region of Uttarakhand, India. Int.J.Curr.Microbiol.App.Sci. 8(05): 1149-1157. doi: <https://doi.org/10.20546/ijcmas.2019.805.130>
6. Hati, K.M., Biswas, A. K., Somasundaram, J., Mohanty, M., Singh, R. K., Sinha, N. K., Chaudhary, R. S. 2020. Soil Organic Carbon Dynamics and Carbon Sequestration Under Conservation Tillage in Tropical Vertisols. In: Ghosh, P., Mahanta, S., Mandal, D., Mandal, B., Ramakrishnan, S. (eds) Carbon Management in Tropical and Sub-Tropical Terrestrial Systems. Springer, Singapore. <https://doi.org/10.1007/978-981-13-9628-1_12>
7. Hemathilake, D.M.K.S. and Gunathilake, D.M.C.C. 2022. Chapter 31 - Agricultural productivity and food supply to meet increased demands, Editor(s): Rajeev Bhat, Future Foods, Academic Press, Pages 539-553, ISBN 9780323910019, <https://doi.org/10.1016/B978-0-323-91001-9.00016-5>.
8. Henning, J. 1994. Economics of Organic farming in Canada. The Economics of Organic Farming – An International Perspective, (Eds.) by Lampkin, N.H. and Padel,S., Wallinford Oxon, UK: CAB International publisher. 143 – 159.
9. Howard, A. 1940. An Agricultural Testament. Copyright 1943 by Oxford University Press, Inc. First published in England, 1940.
10. IFDA. 2005. [www.ifda.com](http://www.ifda.com)
11. IFOAM. 2008. Annual Report
12. (<http://www.ifaom.org/about_ifaom/inside_ifaom/pdfs/IFAOM_Annual_Report_2008.pdf> )
13. Jangid, M. K., Khan, I. M. and Singh, S. 2012. Constraints Faced by the Organic and Conventional Farmers in Adoption of Organic Farming Practices. *Indian Research Journal of Extension Education*, Special Issue (Volume II). Pp. 28-32
14. Khan, M.J., Zia, M. Z. and Qasim, M. 2010. Use of Pesticides and Their Role in Environmental Pollution. World Academy of Science, Engineering and Technology Vol:4 2010-12-25
15. Lampkin N. H., Padel S. 1994. Organic Farming and Agricultural Policy in Western Europe: An Overview. The Economics of Organic Farming: An International Perspective. (eds.) by Lampkin, N.H. and Padel, S. Wallingford Oxon, U.K. CAB INTERNATIONAL, 437-454
16. Mahata., G. 2021. Certification and Challenges of Organic Farming in India. *Just Agriculture, multidisciplinary e- newsletter*.2(1),1-5
17. <https://justagriculture.in/files/newsletter/2021/september/84.%20Certification%20and%20Challenges%20of%20Organic%20Farming%20in%20India.pdf>
18. Mondal, S., Palit, D. 2021. Agroecology for Sustainable Food System and Footprint Mitigation. In: Banerjee, A., Meena, R.S., Jhariya, M.K., Yadav, D.K. (eds) Agroecological Footprints Management for Sustainable Food System. Springer, Singapore. <https://doi.org/10.1007/978-981-15-9496-0_>
19. Ondrasek, G.; Horvatinec, J.; Kovaˇci´c, M.B.; Relji´c, M.; Vincekovi´c, M.; Rathod, S.; Bandumula, N.; Dharavath, R.; Rashid, M.I.; Panfilova, O.; et al. Land Resources in Organic Agriculture: Trends and Challenges in the Twenty-First Century from Global to Croatian Contexts. Agronomy 2023, 13, 1544. https:// doi.org/10.3390/agronomy13061544
20. [Ononogbo](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-C_-Ononogbo-Aff1), C.,  [Ohwofadjeke](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-P__O_-Ohwofadjeke-Aff1), P. O., [Chukwu](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-M__M_-Chukwu-Aff1), M. M.,  [Nwawuike](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-N_-Nwawuike-Aff2), N., [Obinduka](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-F_-Obinduka-Aff2), F.,  [Nwosu](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-O__U_-Nwosu-Aff2), O. U., [Ugenyi](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-A__U_-Ugenyi-Aff2), A. U., [Nzeh](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-I__C_-Nzeh-Aff3), I. C., [Nwosu](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-E__C_-Nwosu-Aff4), E. C., [Nwakuba](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-N__R_-Nwakuba-Aff4), N. R., [Osuagwu](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-C__O_-Osuagwu-Aff5-Aff6), C. O., [Echeta](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-D__O_-Echeta-Aff7), D. O., [Eze](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-V__C_-Eze-Aff8), V. C., [Obodo](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-R__M_-Obodo-Aff9), R. M., [Aniezi](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-J__N_-Aniezi-Aff9), J. N., and [Eze](https://link.springer.com/article/10.1007/s10668-024-05435-2#auth-C__C_-Eze-Aff10), C. C. 2024.  Agricultural and environmental sustainability in nigeria: a review of challenges and possible eco-friendly remedies. *Environ Dev Sustain*. 1573-2975. <https://doi.org/10.1007/s10668-024-05435-2>
21. Patel, S.K., Sharma, A. & Singh, G.S. 2020. Traditional agricultural practices in India: an approach for environmental sustainability and food security. *Energ. Ecol. Environ.* **5**, 253–271. <https://doi.org/10.1007/s40974-020-00158-2>
22. Peter, S.1991. Organic and Conventional cropping beyond transition. Organic Farmers, 2: 13-18.
23. Randive, K., Raut, T. andJawadand, S. 2021. An overview of the global fertilizer trends and India’s position in 2020. *Miner Econ.* **34**, 371–384. <https://doi.org/10.1007/s13563-020-00246-z>
24. Ravisankar, N., Panwar, A.S., Prasad, K., Kumar, V. and Bhaskar, S. 2017. Organic Farming Crop Production Guide, Network Project on Organic Farming, ICAR-Indian Institute of Farming Systems Research, Modipuram, Meerut-250 110, Uttar Pradesh, India. p. 586.
25. Roychowdhury, R., Banerjee, U., Sofkova, S., and Tah, J. 2013. Organic farming for crop improvement and sustainable agriculture in the era of climate change. Online J. Biol. Sci. 13(2): 50–65. doi: 10.3844/ojbsci.2013.50.65
26. Sanghi, N.K. 2007. Beyond certified organic farming: An emerging paradigm for rainfed agriculture, Proceedings of the National Workshop on New Paradigm for Rainfed Farming: Redesigning Support Systems and Incentives, 27-29 September, IARI, New Delhi.
27. Sartain, J.B. 1990. Leaching studies involving selected slow- release N sources, Turfgrass research in Florida- A technical report. Univ. Fla. (Eds.) Freeman, T.E., Gainesville. P. 77-84
28. Scialabba, N. 2000. Factors influencing organic agriculture policies with a focus on developing countries, IFOAM 2000 Scientific Conference, Basel, Switzerland, 28-31 August 2000.

Sehgal J. and Abrol I.P. 1994. Soil Degradation in India: Status and Impact. Oxford University Press: New Delhi, India.

Selvan, T., Panmei, L., Murasing, K.K., Guleria, V., Ramesh, K.R., Bhardwaj, D.R., Thakur, C.L., Kumar, D., Sharma, P., Singh, D., Umedsinh, R., Kayalvizhi, D. and Deshmukh, H.K. 2023. Circular economy in agriculture: unleashing the potential of integrated organic farming for food security and sustainable development. *Front. Sustain. Food Syst.* 7:1170380. doi: <https://doi.org/10.3389/fsufs.2023.1170380>

Sellen, D., Tolman, J. H., McLeod, D. G. R., Weersink, A., &Yiridoe, E. K. 1996. A Comparison of Financial Returns During Early Transition from Conventional to Organic Vegetable Production. *Journal of Vegetable Crop Production*, *1*(2), 11–39. <https://doi.org/10.1300/J068v01n02_03>

1. [Sharma](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Anket-Sharma-Aff1-Aff2), A., [Kumar](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Vinod-Kumar-Aff3), V., [Shahzad](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Babar-Shahzad-Aff4), B., [Tanveer](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Mohsin-Tanveer-Aff4), M.,  [Sidhu](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Gagan_Preet_Singh-Sidhu-Aff5), G.P. S, [Handa](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Neha-Handa-Aff2-Aff6), N., [Kaur Kohli](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Sukhmeen_Kaur-Kohli-Aff2), S., [Yadav](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Poonam-Yadav-Aff2), P., [Shreeya Bali](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Aditi_Shreeya-Bali-Aff7), A.S., [Parihar](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Ripu_Daman-Parihar-Aff8), R. D., [Dar](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Owias_Iqbal-Dar-Aff9), O. I, [Singh](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Kirpal-Singh-Aff9), K., [Jasrotia](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Shivam-Jasrotia-Aff9), S., [Bakshi](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Palak-Bakshi-Aff2), P., [Ramakrishnan](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-M_-Ramakrishnan-Aff10), M., [Kumar](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Sandeep-Kumar-Aff11), S., [Bhardwaj](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Renu-Bhardwaj-Aff2), R.,  &  [Thukral](https://link.springer.com/article/10.1007/s42452-019-1485-1#auth-Ashwani_Kumar-Thukral-Aff2), A.K ,. 2019. Worldwide pesticide usage and its impacts on ecosystem. *SN Appl. Sci.* **1**, 1446 <https://doi.org/10.1007/s42452-019-1485-1>
2. Sharma, G., Sharma, D.K., Sharma, K.L., Pratap, T., Sharma, M. 2008. Empirical Study on a new paradigm shift from chemicalization to organic farming- A Total Quality Management Perspective. Financing Agriculture, A National Journal of Agriculture & Rural Development. Nov- Dec, 8-14
3. Sharma, S., Singh, P., Chauhan, S. *et al.* 2022. Landscape position and slope aspects impacts on soil organic carbon pool and biological indicators of a fragile ecosystem in high-altitude cold arid region. *J Soil Sci Plant Nutr* **22**, 2612–2632. <https://doi.org/10.1007/s42729-022-00831-x>
4. Shukla, A.K., Behera, S.K., Chaudhari, S.K., and Singh, G., 2022. Fertilizer Use in Indian Agriculture and its Impact on Human Health and Environment. *Indian Journal of Fertilisers*, 18 (3) : 218-237
5. Singh, B. and Craswell, E. 2021. Fertilizers and nitrate pollution of surface and ground water: an increasingly pervasive global problem. *SN Appl. Sci.* **3**, 518 <https://doi.org/10.1007/s42452-021-04521-8>
6. Snyder, G.H., Augustin, B.J., Davidson, J.M. 1984. Moisture sensor controlled irrigation for reducing nitrogen leaching in Bermuda grass turf. Agron. J. 76: 964 – 969.
7. Srivastav, A.L., Patel, N., Rani, L. *et al.*  2024. Sustainable options for fertilizer management in agriculture to prevent water contamination: a review. *Environ Dev Sustain* **26**, 8303–8327. <https://doi.org/10.1007/s10668-023-03117-z>
8. U.S. Department of Agriculture, USDA study Team on Organic Farming. 1980. Report and Recommendation on Organic farming, July, U.S. G.T.O. No. 620-220/3641.
9. Veeresh, G. K.1999. Organic Farming Ecologically Sound and Economically Sustainable, Plant Horti Tech, 1(3), Nov-Dec.
10. Vogtmann, H. Matthies, K., Kehres, B., Meierploeger, A. 1993. Enhanced food quality: effect of compost on the quality of plant foods. Compost Science and utilize.1: 82- 100.
11. Younisi, H. and Makadia, J.J. 2018. Opportunities and Challenges for Marketing of Organic Products in India. Indian Journal of Economics and Development. 14(1), 174-177 DOI: 10.5958/2322-0430.2018.00022.7