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Organic Farming: Balancing Sustainability and Economic Viability

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Abstract

This study examines the economics of organic farming, emphasizing its importance in light of the growing demand from consumers for organic goods and the harm that conventional agrochemical-based agriculture causes to the environment. Although the 1960s green revolution increased agricultural yields, the overuse of synthetic inputs raised questions about environmental sustainability and public health. The demand for organic and non-GMO products is rising by 16% annually, according to recent trends, which is pushing farmers to use more environmentally friendly methods. The ability of organic farming to maintain global food security is still problematic, though, especially in heavily populated areas like South Asia. This study explores the trade-offs between sustainability and yield, finding that although organic farming may result in lower crop yields, its advantages—such as improved biodiversity and soil health—can contribute to long-term agricultural sustainability. The results advance our understanding of the ecological benefits and economic feasibility of organic farming.

Keywords: *Sustainable farming, Agriculture economics, Organic food market, Green revolution and Agrochemical impact*

1. Introduction

Organic farming has become a vital substitute for traditional farming methods, providing notable advantages for both the environment and human health. Globally, the trend toward organic farming is accelerating as worries about the negative impacts of chemical pesticides, fertilizers, and unsustainable farming methods grow. Traditionally input-intensive, agrochemical-based agriculture has improved yields and addressed issues related to global food security during the 1960s green revolution. But the environment and public health have been impacted by the persistent, unbalanced, and frequently excessive use of synthetic pesticides and fertilisers (Reganold and Watchter, 2016). Thus, over time, there has been a rise in demand for organic and non-chemical agricultural products. Consumer demand for natural products has increased at a rate of 16% annually during the last ten years (Khangan, 2020). Additionally, growing demand for foods that are not genetically modified (GMO) and the rising prices of chemical inputs like pesticides and fertilisers are pushing farmers towards organic and ecologically friendly farming practices (Patil *et al*., 2014). Organic farming relies less on external agricultural inputs like synthetic pesticides and chemical fertilisers and a greater emphasis on ecosystem management (Vojir *et al*., 2012). However, at the policy level, there have been questions raised over how well organic farming can feed the world's population. These issues are particularly pertinent in densely populated regions such as

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South Asia, where organic farming affects yield, profitable farming, and income per unit of agricultural output (Gomiero *et al*., 2011). Multiple investigations have shown that organic farming significantly lowers crop yields (Seufert *et al*., 2012). While other studies show that crop production variability has increased (Olivia *et al*., 2019). Studies have also shown that the benefits of organic farming, such as higher soil organic carbon content, organic matter, and biodiversity at the farm level, more than make up for yield losses by improving sustainability (Reganold and Wachter, 2016). As a result, perspectives regarding the advantages and disadvantages of organic agriculture vary greatly (Meemken and Qaim, 2018). The purpose of this paper is to present a comprehensive understanding of how organic farming can eventually be both economically and environmentally sustainable.

2. Consumption and Export Trends of Organic Food in India

Many people have the false impression that organic food is merely a flimsy idea intended mainly for wealthy nations. Furthermore, a large portion of organic food is produced just for export, despite India's best efforts to emphasise this. It's not true, though. Many people seek out organic food for local consumption, despite the fact that 51% of India's organic food output is intended for export (Ministry of Commerce & Industry, 2021). Children's health was the primary deterrent to the general public's shift towards organic food consumption. Compared to their conventional counterparts, organic produce was 63% more expensive (Kavitha and Chandran, 2018). However, because organic food is thought to have additional health advantages and has been deemed totally safe for household use, many parents are now willing to pay this greater price. The fact that there are an increasing number of organic food stores in India indicates that the country's consumption of organic food is rising (Rekha Mishra and Neeraj Kaushik, 2013). These days, a lot of restaurants and retail food stores have to serve organic food. India's consumption pattern of organic food differs significantly from that of Western nations. However, Indian consumers of organic food need to be educated. Many consumers are unaware of the distinction between natural and organic food (Srivastava, 2021).

Many consumers buy products that have the tag "Natural," assuming them to be Organic.

In addition, consumers do not know about the authentication process. Since Indian domestic retail is not certified, it has many fake organic products available for sale. Due to the growing number of farmers using organic farming methods, India is exporting more organic food for consumption. India is now a major supplier of organic herbs, spices, and basmati rice, among other products (Mahapatra *et al*., 2009). When comparing the fiscal year 2020-21 to the previous fiscal year (2019-20), India's exports of organic food products increased by 51% in terms of value (US$ mn) to US$ 1040 mn (₹7078 cr) (Ministry of Commerce & Industry, 2021). The total India total organic food items' export 11,295 sale (Tons) including all organic food such as Rice, Wheat, Pulses, oilseeds vegetables and fruits, tea., etc. (Sharma, and Singh, 2023).

Currently, India exports the following organic food products:

- Organic Cereals- Rice, Wheat, Maize, etc.
- Organic Pulses- Black gram, red gram
- Organic Fruits- Mango, Orange, Pineapple, Banana, Walnut, Cashew nut, etc.
- Organic Oils and Oils Seeds- Soybean, Sunflower, Mustard, Cotton seed, Castor, etc.
- Organic Vegetables- Tomato, potato, Garlic, Brinjal, etc.
- Organic Herbs and Spices- Turmeric, Chilli, Black pepper, Clove, White pepper, etc.
- Others- Coffee, Tea, Sugar, Cotton, etc.

3. Organic and Conventional Production Systems: A Comparative Analysis

3.1. General Comparisons

When compared to conventional farming methods, organic farming is characterised by higher output prices, lower yields, and lower input utilization (Durham and Tamás, 2021). Even though it can be challenging to quantify and contrast naturally produced and conventional farming practices, there are substantial environmental advantages to this production method on farms (Cacek and Linda, 1986). Examined and contrasted conventional corn-soybean crop rotation methods with organic animal-based and organic legume-based systems. Conventional crops yielded more under normal weather conditions. In contrast, organic systems fared considerably better during drought conditions (about 30%). During the 10-year period under analysis, the average decrease in corn yield was only 3% (Pimentel *et al*., 2005). And Cavigelli conducted a field trial on a 16-hectare study site to evaluate the long-term economic performance of conventional and

organic field crops. In addition to lower production costs and yields, organic systems produced 2.4 times higher net returns at lower risk, with an average price premium of 111–138% (Cavigelli *et al.*, 2009).

3.2. Comparisons Particular to a Product

The most popular methods used by tiny farmers contract farms producing organic coffee in tropical Africa were composting, mulching, animal waste, and organic pesticides. Farmers were encouraged to join an organic system by higher net coffee revenue, which averaged 75% (Bolwig *et al.*, 2009). The benefits from using more organic practices (cheap and efficient farming methods) were less than this impact. Because of the increased coffee yield, this was 9% per practice. Contracting offers a price premium if quality requirements are satisfied and appears to lessen farmer uncertainty around net returns (Bolwig *et al.*, 2009). Carried out a production and establishment research to give producers a tool for financial management and decision-making. They pointed out that growing blueberries is costly, and that yield and price per pound determine profitability. The type of soil, management techniques, and cultivar/variety grown all affect an established farm's yield. Additionally, there is a lot of variances in the time it takes to attain maximum productivity; some farms may take up to seven years (Julian *et al.*, 2011).

3.3. Switching Conventional Farming to Organic Agriculture

There are several factors that come into play while switching from conventional to organic farming. As previously shown, this calls for a change in perspective and a move away from strategies and inputs (synthetic chemicals) that are currently banned in favour of a more labour-intensive paradigm. The country's legislation and the goods will determine how long the transformation takes. It is necessary to use organic farming methods throughout this period.

Indicated that small-scale farmers in underdeveloped nations would benefit more from a transition to organic produce. With improved seeds, organic fertiliser, and technological support, they may increase their harvests. Although organic farming may require more work, the cheaper input costs may make up for it. However, organic conversions are not without risks. Because of tiny along with emerging organic markets, growing crops organically entails a larger price risk; nonetheless, organic yields typically do not change more than conventional yields (Qiao *et al.*, 2016).

Economic and agricultural data from a comparative experiment of farming systems in central India over the 2007–2010 conversion phase (Forster *et al.*, 2013). The impacts of conventional, organic, and biodynamic management on a crop rotation of wheat, soybeans, and cotton were investigated. Both cotton (229%), and wheat (227%) showed a discernible production variance between standard and organic agricultural practices in the first crop cycle (Forster *et al.*, 2013). That difference did, however, significantly close in the next crop cycle. Because organic farming systems had lower variable production costs (but similar yields) in cycle two, their gross margins were much greater (+25%) than those of conventional farming systems, which on average had much larger gross margins in cycle one (+29%) (Forster *et al.*, 2013). Compared to traditional agricultural systems, organic farming techniques need less capital. Smallholder farmers, who usually lack the funds to buy inputs and would otherwise have to apply for loans, would find this of special interest. Because of this, organic farmers may be less vulnerable to the financial hazards brought on by changes in the price of synthetic fertilizers and angioprotectin's (Forster *et al.*, 2013).

4. Farmers' Perceptions About Organic Agriculture

The behavioral principles established by Chetsumon and Wheeler were used in this part to evaluate farmers' attitudes regarding organic farming (Chetsumon, 2005). There were five sections to the indicators (Figure 1). A little over 46% of farmers claimed to have switched to organic farming for reasons related to food safety and health. Organic farming was adopted for a second reason: to lower manufacturing costs. The significance of agricultural officers' work was demonstrated by the fact that 32% of farmers stated they switched to organic farming as a result of guidance from these government officials. Because the majority of private businesses offer chemical pesticides and fertilisers, their ability to support organic farming was limited—only 12% of respondents said they would do so. The biggest obstacle to switching to organic farming, according to research, was that 57% of farmers lacked certification, which prevented them from charging a premium.

Moreover, labor (especially family labour) and organic input scarcity were major restriction, since labor-intensive organic farming requires more work than conventional farming. Farmers are reluctant to switch to organic farming even if it is less expensive to broadly implement it because to its poor yields, increased labour and supervision needs, and absence of premium cost (Hou *et al.*, 2010). For their personal needs, some farmers favor organic agriculture requirements for consumption. In general, farmers believe that the government ought to assist in providing subsidised organic inputs and guaranteed top dollar for their product in order to encourage broader use type farming that is organic.

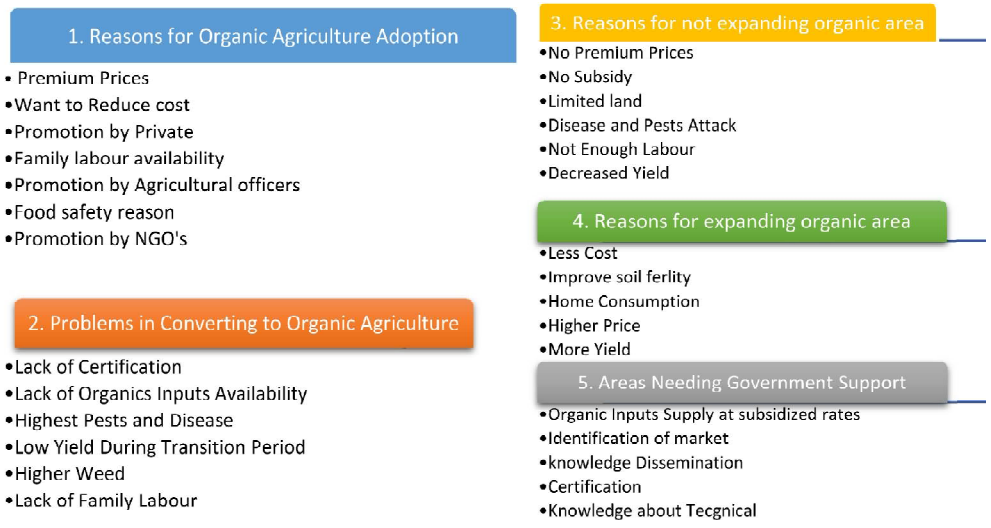

Figure 1: Farmer's Perception About Organic Agriculture

5. Market Trends in Organic Manure

India's market for organic goods is expanding quickly because to government support, growing environmental concerns, and growing health consciousness. In order to avoid synthetic chemicals, more Indian consumers are selecting organic fruits, vegetables, cereals, and spices. The Indian government has started programs such as the PKVY, which offers incentives for organic farming, to help farmers transition to organic methods. E-commerce companies and other retailers are expanding their selection of organic products to make them more accessible to customers. Notwithstanding this expansion, the organic industry still confronts obstacles like exorbitant certification costs, a weak supply chain, and a lack of knowledge among some customer segments. The expansion of India's organic agriculture is also greatly aided by export demand, especially from countries like the US and Europe, which has made India a major supplier of organic produce worldwide.

In chart 1, demonstrates a consistent increase in organic manure prices in India between 1950-51 and 2022-23. Due to inflation, costs increased dramatically from ₹166.56 to ₹56355 cr at current pricing. Actual costs increased more modestly from ₹13266.33 to ₹23761 cr in constant prices (2011-12 base), showing modest actual growth over time. This emphasises the effects of inflation as well as the steady rise in the cost of agricultural inputs.

Chart 1: Data on India's "Output & Value Added from the Crop Sector" for organic manure inputs, especially, from 1950-51 to 2022-23 is shown. In the framework of India's National Accounts Statistics, it provides figures at both current and constant prices, showing the evolution of spending on organic manure over time (based on the 2011-12 series).

Figures given from 2011-12 to 2022-23.

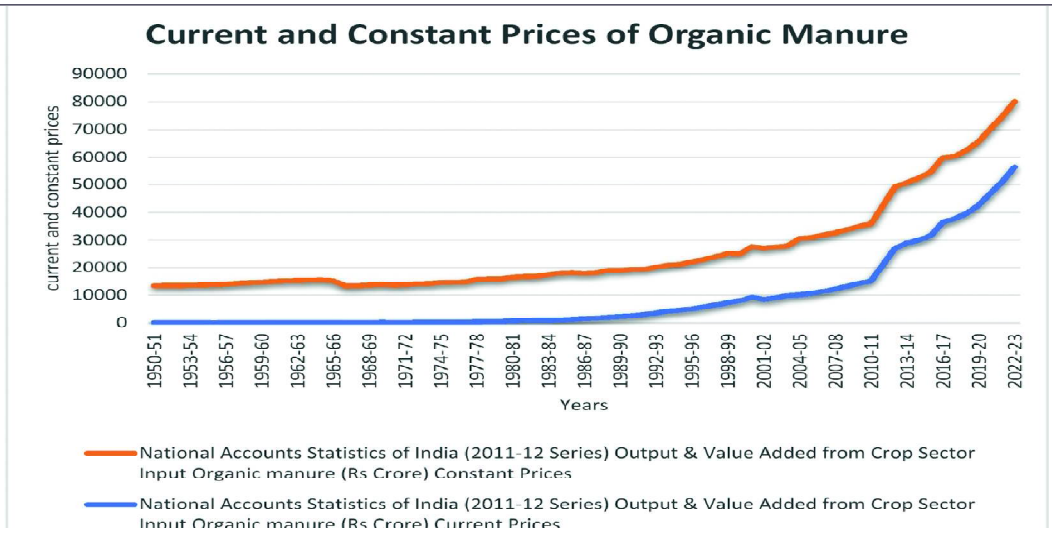

Figure 2: Current and Constant Price of Organic Farming (Based on the 2011-12 series).

6. Demand from Consumers for Organic Products

Over the past ten years, there has been a significant surge of consumer demand towards organic products (Du *et al*., 2017). Since organic products are made from natural components, artificial fertilisers and chemicals are presumably avoided. Therefore, to qualify as organic, a product needs to be approved by ecological accreditation, have been produced in a way that respects the land, avoids the use of chemicals, and protects its nutrients. By preventing ongoing exposure to chemical products, its consumption saves the health of farmers and laborers who produce it in addition to the consumers themselves. In addition, organic farmers work to guarantee resource sustainability as a sign of their concern for coming generations. Organic products are beneficial to both consumers and the environment. Because organic products are of superior quality, do not include any potentially dangerous ingredients, and do not contain synthetic additives, consumers see them as advantageous. By eliminating the use of harmful chemicals in the product's manufacturing, the damage to plant and animal species is reduced, and the water and soil are protected. Because they require more labour to produce, organic products create jobs. As a result, they help the environment, support ecosystem preservation, and promote more sustainable rural development.

The word "ecological" is becoming more and more common in consumers' lives, creating new demands that businesses try to meet (Miranda *et al.*, 2017). The behavior of those looking for alternatives to the consumption of conventional products reflects the growing concern in recent years for both personal health and the sustainability of the environment. There is no information on the number of organic products consumed domestically. It is a fact, however, that as health consciousness and interest in organic farming grow, so does the home market's desire for organic products. Between 2022 and 2027, the food of Indian organic industry is expected to expand at a compound annual growth rate of 25.25 percent, according to the IMARC analysis. Exports of organic products throughout the previous three years (Ministry of Agriculture & Farmers Welfare, 2023).

Table 1: Showing Organic Product Exports by Value Over the Previous Three Years

Year	Exported Qty (MT)	Value (Crore)	Value (USD Million)
2019-20	638998	4686	689.1
2020-21	888179	7078.5	1040.96
2021-22	460320	5249.32	771.96

7. Government Policies and Subsidies in Organic Agriculture

Since 2015-16, the government has promoted chemical-free organic farming through particular programs called the PKVY and MOVCDNER, in response to the growing demand for organic products. Both initiatives help organic farmers with post-harvest handling, including packaging and processing, as well as organic growing, certification, and marketing. Information about the areas and farmers in different states that are involved in organic farming. As a subscheme of the PKVY, BPKP was introduced in 2020-22 to support traditional indigenous methods like Natural Farming (NF). The program encourages the recycling of biomass on farms, with a focus on biomass mulching, the use of cow dung-urine formulations, and plant-based preparations. It also emphasizes the elimination of all synthetic chemical inputs. Natural farming has so far occupied 4.09 lakh hectares of land, and a total of ₹4980.99 lakh has been made available in eight states across the country. Beginning with this program, the government has given individual farmers who own 8.0 hectares or more of land financial support for three years at a rate of 2700 per hectare in order to obtain certification under the PGS or NPOP through the Regional Council.

Organic farming improves crop productivity and soil fertility. Studies carried out as part of the ICAR-All India Network Programme on Organic Farming show that after five years, the yield of rabi crops stabilizes, while kharif and summer crops can provide yields equivalent to or marginally higher than those of conventional management within two to three years. "Organic inputs such as seeds, compost/vermi-compost, organic manure, bio-fertilizers, bio-pesticides, botanical extracts can be availed by farmers under the PKVY scheme at ₹31000/ha for three years and under the MOVCDNER scheme at ₹32500/ha for three years. Furthermore, organic produce marketing, value addition, certification, training, and the establishment of Farmers Producers Organizations (FPOs) can all receive assistance. For three years, BPKP offers financial support of ₹12200 per hectare for cluster formation, capacity building, certification, residue analysis, and routine monitoring by trained personnel (Delhi, 2022).

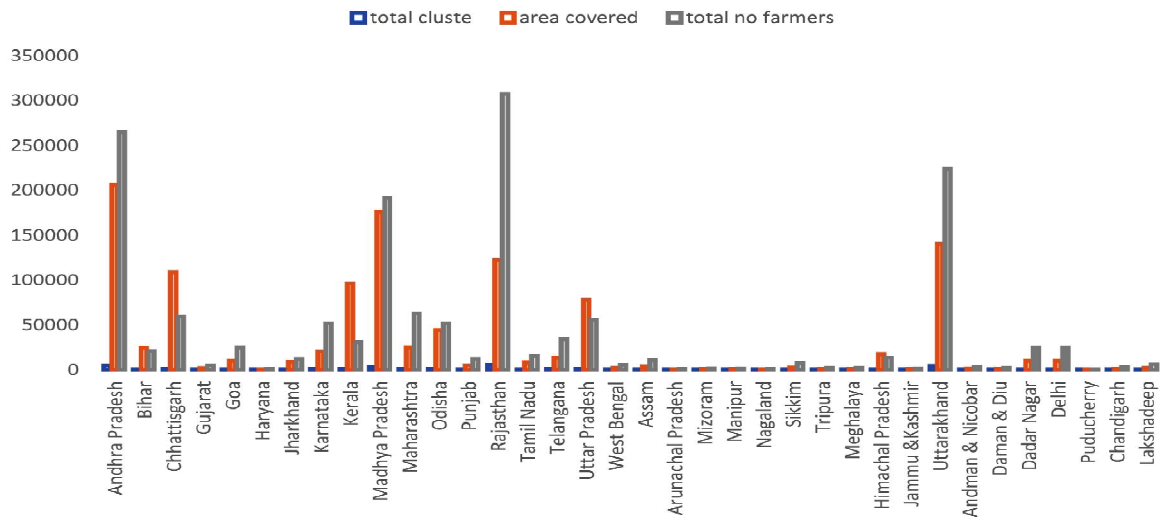

Figure 3: Farmers, States, and Areas Covered by the Parampragat Krishi Vikas Yojana Program Since 2015-16

8. Challenges and Barriers in Organic Farming

However, a number of obstacles still exist even though organic farming is widely accepted in India. The numerous important issues brought to light in recent research are reviewed in this section.

8.1. Absence of Import and Domestic Market Policies

With a primary concentration and export-oriented production, India's current organic farming policy does not pay much consideration to the establishment of organic farming regulations for the local market and imports. In light of this, the lack of regulations governing organic production labelling standards and logos increases the likelihood that farmers and consumers will not be able to distinguish between organic and conventional products. As a result, since consumers are willing to pay for organic products, fraudulent activities keep legitimate parties from benefiting (Pathania, 2020).

8.2. Cost Related Constraints

The yield of organic farming is lower than that of conventional farming. According to some studies, a major shift to organic farming could reduce crop yields by 40% worldwide, resulting in an estimated amount of crop failure required to feed about 2.5 billion people (Jouzi *et al*., 2017). Because organic farming doesn't use chemical fertilizers, it produces less food than conventional farming, and it takes up a lot more space to produce the same amount of organic food (Das *et al.*, 2020). The organic value chains are not without risks and limitations (Abele *et al*., 2007). Another significant issue is managing nutrients. Keeping the soil's nutrient input and output balanced is also crucial because organic farms don't import artificial ingredients (Jouzi *et al*., 2017). Experience with intensive organic production, particularly with fruits and vegetables, is also lacking (Abele *et al*., 2007). Small-holders are usually disregarded in research and extension plans and programs, despite the fact that small-scale farmers need appropriate research and investments that concentrate on their unique needs in order to improve their status (Jouzi *et al*., 2017).

8.3. Insufficient Organic Seeds to Encourage Organic Agriculture

The native cultivars are susceptible to simultaneous use of genetic and fertilizer-sensitive planting materials and seeds due to their sensitivity to chemicals and fertilisers. This causes marked inequalities in access to premium organic seeds, scaring off farmers from adopting organic practices.

Issues of cooperation from all parties involved in India's sustainable agricultural sector need to be addressed. Sponsorship of research and improvement of technology could help the farmer adjust to consequences pertaining to climate change, along with the creations of awareness of organic farming benefits and laws for the protection of the facilities and assistance services of organic farmers. Governments may stimulate the production and distribution of naturally grown seeds, for example, by collaborating with seed companies and offering incentives to growers who utilize those seeds. Decomposition and organic fertilizers may also enhance long-term crop yields through stimulating soil fertility and decreasing dependence regarding artificial fertilizers.

9. Future of Organic Farming in India

India has 140.1 million hectares of net cultivated land, making it one of the nations with the most arable land in the world (NCONF 2023). Together, they comprise the farming industry, which serves as the country's primary source of income and contributes between 20 and 30 percent of household income. The advent of modern innovations and the country's rapidly growing population have led to the widespread acceptance of conventional farming as a solution to India's food issue, even if organic farming is a kind of conventional farming in the country. But growing knowledge of the chemical's effects on soil health and worries about the quality and safety of food are fuelling the market for organic goods [23]. India has an ideal environment for sustainable agriculture because of its vast drylands, established traditional farmers, robust regional farming system, and copious amounts of rainfall in the northeastern mountainous regions. The present knowledge of historic farming systems provides a solid foundation for improving modern organic output. India is the largest manufacturer of organic products worldwide (Shahbandeh, 2024). Many innovations in organic farming, including 3D printing, the use of mycorrhizal fungi and nano bio stimulants, and agroecological techniques, present promising prospects for an improved organic farming system in the future (Pavani *et al.*, 2022).

10. Conclusion

In conclusion, this study emphasizes organic farming's growing importance in response to environmental degradation brought on by conventional farming practices, highlighting the delicate balance between sustainability and economic viability. Despite the potential for lower yields, organic farming offers long-term sustainability advantages due to its positive effects on the environment, including increased biodiversity, healthier soil, and less chemical pollution. The growing demand for organic food worldwide, which is being driven by health-conscious consumers and a growing awareness of the detrimental effects of agrochemicals, is highlighted by India's emergence as a major producer and exporter of organic products. Organic farming has enormous potential to support both environmental sustainability and rural economic development, despite obstacles like increased labor costs, restricted access to organic seeds, and price volatility. As the demand for organic food grows, particularly in India, the future viability and scalability of organic agriculture will depend heavily on sustained government policy support, innovative farming methods, and improved farmer education.

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